

consulting engineer

February 1956

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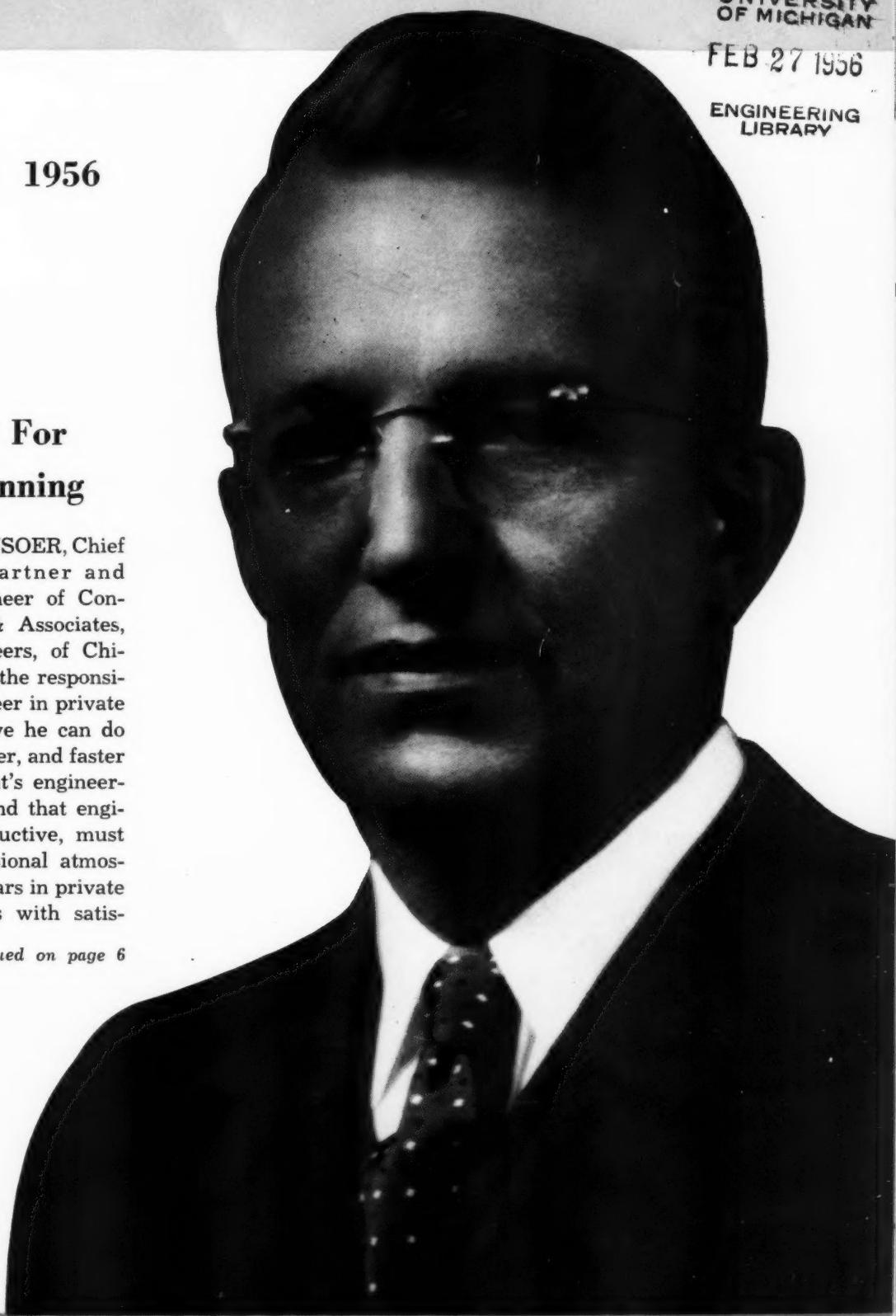
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A Need For Bold Planning

ARTHUR W. CONSOER, Chief Executive Partner and Supervising Engineer of Consoer, Townsend & Associates, Consulting Engineers, of Chicago, Ill., believes the responsibility of the engineer in private practice is to prove he can do a job cheaper, better, and faster than can the client's engineering department, and that engineers, to be productive, must work in a professional atmosphere. After 36 years in private practice, he notes with satis-

—Continued on page 6



The Consulting Engineer's Professional Magazine

Is the (*or equal*) resulting in a (*better than*)?

It used to be that you could automatically specify two or three standard valve makes (*or equal*) and be sure of satisfactory results. But have you recently looked into how frequently the (*or equal*) in a specification is resulting in a *better-than-specified* product being installed?

You, as the original specifying authority, should be the first to be aware of what is (*better than*). That's why we are reserving this space alternately for some time. We want to tell you directly of the OIC (*better than's*) for which there are no (*or equal's*) yet.

THE OHIO INJECTOR COMPANY
Wadsworth, Ohio



VOLUME 7 NUMBER 2

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(See page 124)

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The Consulting Engineer's Professional Magazine

Arthur W. Consoer

—Starts on front cover

faction an accelerated trend in the last three years toward greater reliance on the consultant by industry, public utilities, and public bodies.

A civil engineering graduate of the University of Wisconsin in 1913, he and the firm he helped organize in 1916 have had an Horatio Alger rise. In the early years, activity of the firm was confined to municipal improvement work for Chicago and the surrounding towns and villages. It now has branched out beyond the Middle West to projects across the country. The present staff numbers about 250 with a total of eleven partners.

Specializing in design of all types of municipal improvements and utilities, Consoer is well qualified to give a realistic appraisal of the needs of today's cities—from improved traffic facilities to adequate water and sewerage systems.

"Only bold and skillful planning will save our present cities. There must be an over-all plan that takes into account present needs and future growth. It is important that these projects are not carried out haphazardly, although each opportunity to improve the city must be seized.

"The big need is for cities to get caught up on their water supply needs. I fail to see that most cities can meet maximum daily water demand with present facilities. Think what a fire hazard this is. I, personally, know of sizeable towns where a large fire on a hot, dry summer day could destroy the town because there was not enough water to fight the blaze. Then, too, the average city does not have an adequate sewer system. Many of them have only one sewer system that must take care of both storm carry off and sewage. It is simply a case of more load than the sewers were designed to carry. Milwaukee, Wis. is now making the type of bold plans referred to. They are studying the possibility of installing separation sewers at an estimated cost of \$200 million.

"We must keep in mind that no one of these needs has real priority over the others. They must be planned for simultaneously. City planning, including zoning, a building code that is capable of being enforced, and redevelopment of worn out neighborhoods, must be incorporated in any improvement scheme. Chicago is moving ahead in this direction under leadership of the Chicago Land Clearance Commission. The Commission does the over-all planning and then calls in the consulting engineer and the architect to do the detail planning. In one slum redevelopment project on which we worked for the Commission, we redesigned the entire street pattern and provided for all utilities, using what we could salvage of the old and adding new as needed. One of the improvements incorporated was modern street lighting—another widespread city need. This type of housing project prevents what William Zeckendorf has called horizontalization—the spread of

low income families from the slums to outlying communities. Since they have little money, they buy low cost, poorly built, one family houses. These areas become the slums of tomorrow.

"We have given much thought to city planning here at Consoer, Townsend and Associates. We have associated with us on such work Carl Gardner, former Executive Engineer of the Chicago City Planning Commission, and a well-known planning expert.

"Based on many years of experience in helping cities and towns solve their traffic problems, we favor the building of a network of expressways with a median strip for mass transportation by electric trains, buses, and possibly Monorail. These expressways would radiate out from the center of the city, reaching the suburbs and outlying neighborhoods. They would terminate inside the downtown area in garages and parking lots. The high speed at which the public transportation could travel on the median strip would encourage many people to leave their cars at home. I, for one, would not drive from my home in Park Ridge every day if I could take a bus or electric train that traveled at speeds up to, say, 80 miles an hour.

"Where are we going to find the engineers to plan these improvements? We, the engineers in private practice, must convince the young men graduating from engineering school that their opportunity for advancement is greatest in the consulting engineering field. They must be told that firms such as ours now offer the security once associated only with industry and civil service work—bonuses, profit sharing, non-contributing life insurance, hospitalization, and pension plans—plus the stimulation of working in a truly professional atmosphere.

"My observation is that the young engineer outside the consulting field rises rapidly for a short time and then reaches an intermediate plateau where his advancement proceeds much more slowly. In our office, as in any similar engineering office, advancement is governed solely by how able and willing to work the man is.

"For our men who aspire to their own organizations, we have what we call a satellite arrangement. The engineer opens his own office and, after he has obtained sufficient skill and experience, we may negotiate with him to do part of some of our work. He is in no respect a subcontractor or assignee. He works under our direction and control. An engineer on our staff checks the work. You might say we monitor the operation. The satellite firm may do such work as surveys, plans, and specifications. They are also free to accept independent assignments from clients. After about five years they are usually ready to branch out entirely for themselves, and the satellite arrangement is terminated. For the engineer with special talent it means a chance to start a successful private practice of his own—which should be the aim of every qualified engineer." ▲ ▲

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Reddy Dec. 31, 1954

Reddy Dec. 31, 1953

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Busy as he is in homes, stores, offices and factories, Reddy finds time to look ahead. Far-sighted electric companies throughout the country (and in your town, too) already have charted the nation's power needs for the future and are engaged in a steady, continuing program to insure that an abundant supply of economical electricity always will be available wherever and whenever needed.

Most of the abundant, economical electrical power generated today comes from steam plants burning coal, oil and gas. A large share of this steam is supplied by B&W Boilers incorporating the latest advances in combustion and steam generating technology. As it has for nearly a century, The Babcock & Wilcox Company continues to invest in research, manufacturing facilities and engineering skills needed to keep our steam generating technology ahead of the nation's needs.

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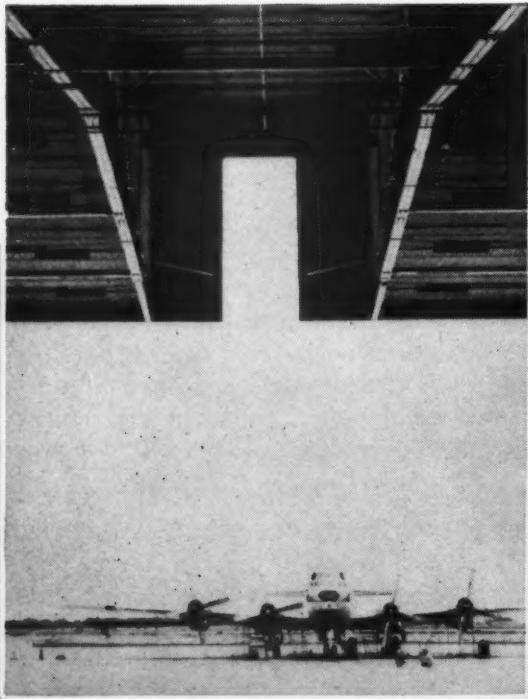
BOILER
DIVISION

N209

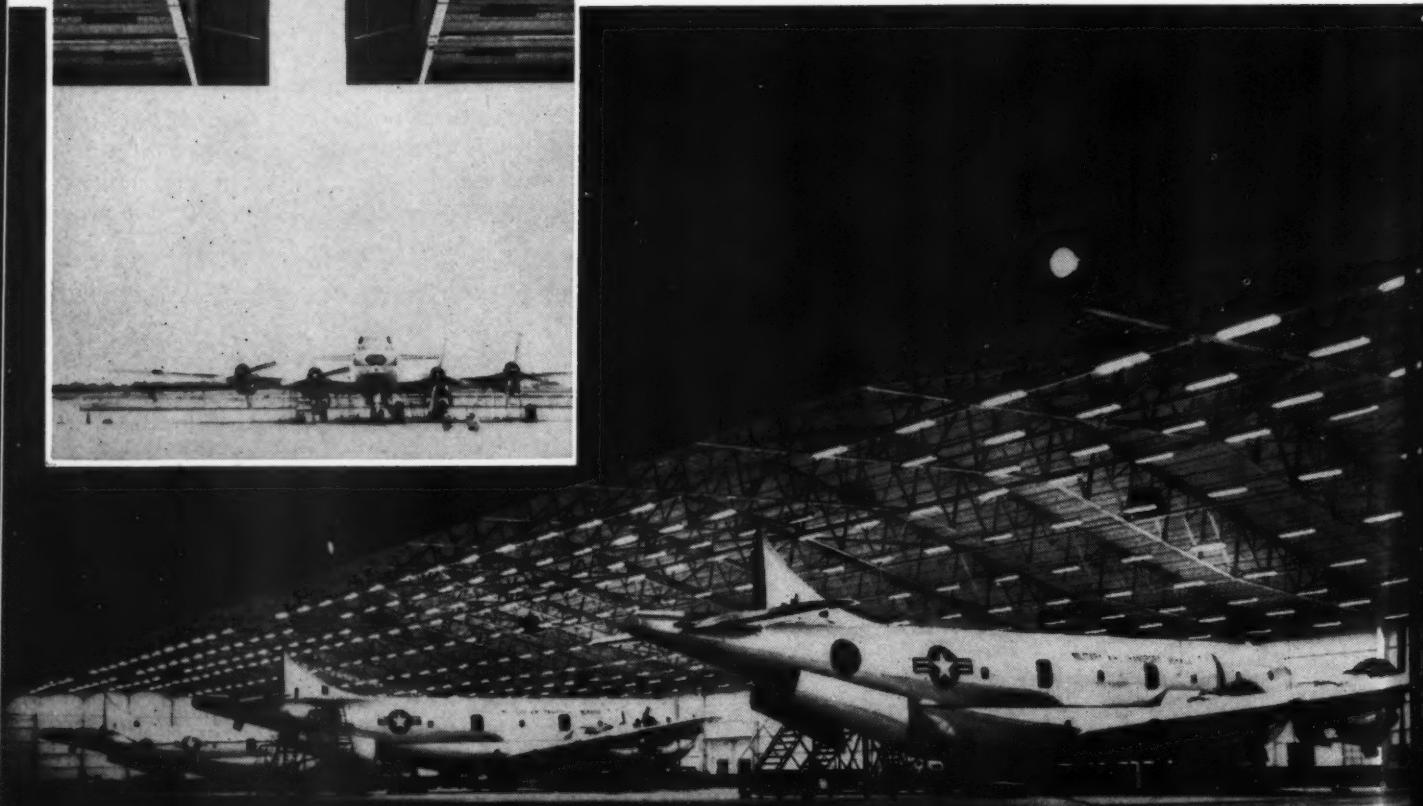


The 76-foot-long member which connects the top ridge of the cantilever to the top of the inner column is designed to act either in tension or compression—supports weight of roof loading, and withstands 30 psf uplift from wind under roof.

Ingenious hangar



Vertical clearance rises to 45 feet inside the three tail housings which open at the edge of the overhanging roof to admit the tails of these Boeing Stratocruisers.



The unique hangar was designed and constructed by the Erwin-Newman Co., of Houston, Texas, under their patent No. 2,687,102.



The hangar is designed for 25 psf roof load and 15 psf horizontal wind force. Rear columns are bolted to deep concrete piers since they must withstand a pull of 14 tons per column from the weight of the cantilevered roof structure, which amounts to only 11.8 psf.

has no columns... cantilever construction spans 120 ft. at cost of only \$2.40 per sq. ft.

• The hangar area of this efficiently-designed building of Temco Aircraft Corporation at Greenville, Texas, is completely unobstructed by supporting columns. The clear area measures 120 ft. deep x 432 ft. long x 30 ft. high.

The roof is carried on 120 ft. steel truss cantilevers, connected by means of rocker joints to 56 ft. tall inner columns, which in turn are joined to 19 ft. outer columns placed 40 feet farther back. The space between the two rows of columns is conveniently used for workshops, parts storage, and offices.

The prefabricated Structural Steel

framework for this hangar was bolted together in *only six working days*. The framing cost \$2.40 per sq. ft. Framing and roofing cost \$3.26, and the complete building including services, foundations, and 32,400 sq. ft. of concrete apron totaled \$5.06 per sq. ft. Approximately 1,000 tons of Structural Steel were used in the building framework. Speedy construction was an important factor in holding down costs.

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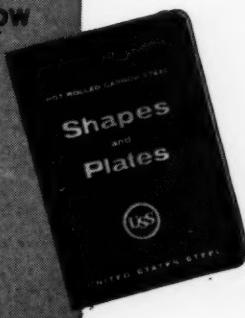
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High School Teaching

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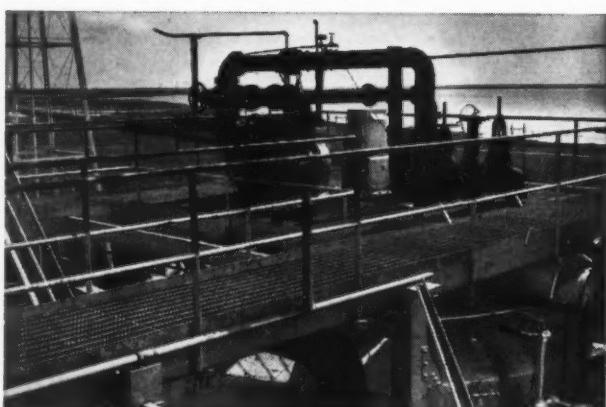
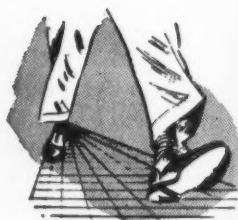
May I call your attention to the urgent need for engineers in the field of high school teaching. If engineers and technicians are to be trained, we must have the necessary teaching personnel. We would deeply appreciate calling to the attention of your readers, the job requirements (qualifications) of the Board of Education of the City of New York.

The basic job facts of interest to

potential teachers with engineering training are these:

1. Graduation from a four year engineering school is required.
2. Minimum engineering experience is three years.
3. Starting salary of a regular teacher who has had five years of engineering experience is \$4888. If he has a master's degree it is \$5288. Increments bring the salary up to a maximum of \$7200, over a period of years, \$7600 with a master's degree. Salary continues until retirement.

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4. The required courses in education may be taken within three years following the teaching examination.

5. There are numerous opportunities for advancement to higher paying positions.

6. There are many "fringe" benefits, some of which include tenure, pension, health benefits, sick leave, insurance after a number of years of service, etc.

For further information call or write to Nathan Clark, Supervisor, Related Technical Subjects, Board of Education, 110 Livingston Street, Brooklyn 1, New York.

Nathan Clark, Supervisor
Related Technical Subjects
Board of Education
The City of New York

National Association

Dear Sir:

As you will note from the questionnaire which I have filled out (CONSULTING ENGINEER Survey, see Jan., p. 56.) I am opposed to an Association of Consulting Engineers and feel rather that such an Association could very well fit into the framework of the National Society of Professional Engineers. Our member state society, the Tennessee Society of Professional Engineers, has done an excellent job in Tennessee in representing the practicing consulting engineer and we have found that things can be accomplished in behalf of the consulting engineer by the sheer weight of numbers making up the membership of TSPE.

There are already too many societies representing the engineering profession and as a result the engineering profession is not well represented on any front. You will note from my answers to the questionnaire that I belong only to the National Society of Professional Engineers, even though I am eligible for membership in the ASCE, ASME, AIEE, and the ASH&VE. . . .

I certainly think it would be advisable to explore very completely the possibilities of forming an association within the framework of NSPE and recommend this be done.

Lorin B. Allen
Allen & Hoshall
Memphis, Tenn.

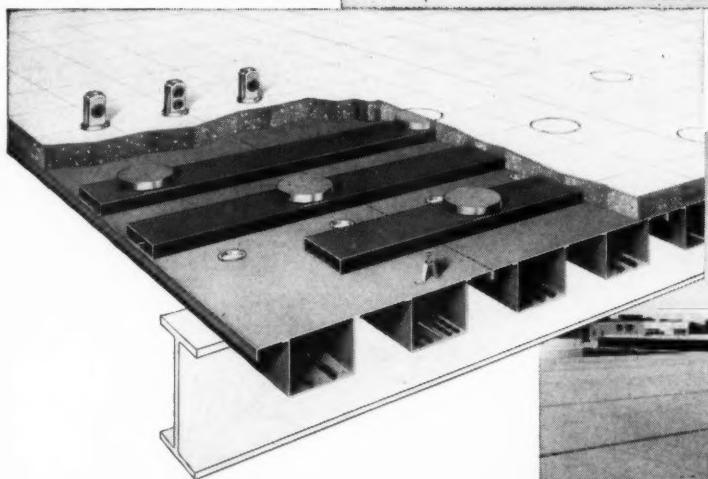
Dear Sir:

The writer has given this matter of engineering organization considerable thought and at the present thinking I believe that there should be one parent organization of qualified engineers, be they consulting,

M-FLOORS

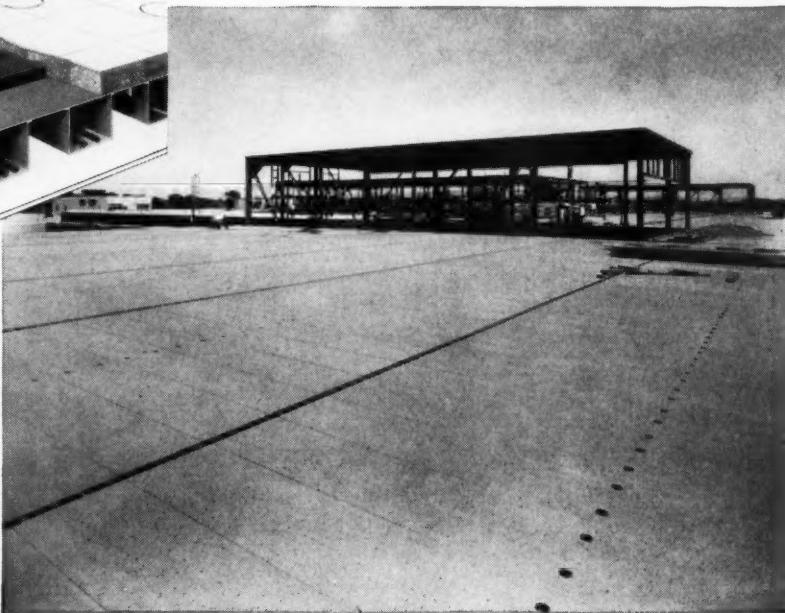
and LONG SPAN

M-DECKS



MAHON M-FLOOR

Cellular Steel Structural Sub-Floor constructed with Mahon M-Floor Cel-Beam Section M2. When energized with an electrical distribution system, Cel-Beams are utilized as continuous electrical raceways. In addition, M-Floors have an unusually high strength to weight ratio which, coupled with rapid erection, produces many cumulative and far-reaching economies in both construction time and cost.

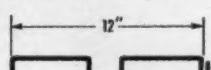


M-Deck Roof Construction. Mahon Long Span M-Deck Sections can be furnished with one, two or three Cel-Beams in various Beam Depths from $1\frac{1}{2}$ " to $7\frac{1}{2}$ " for Spans up to 32 feet.

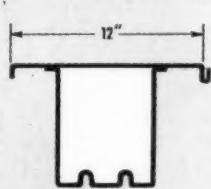
MAHON STEEL DECK and LONG SPAN M-DECK SECTIONS



STANDARD DOUBLE RIB



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SECTION M1



LONG SPAN M-DECK
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LONG SPAN M-DECK
SECTION M3

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MAHON

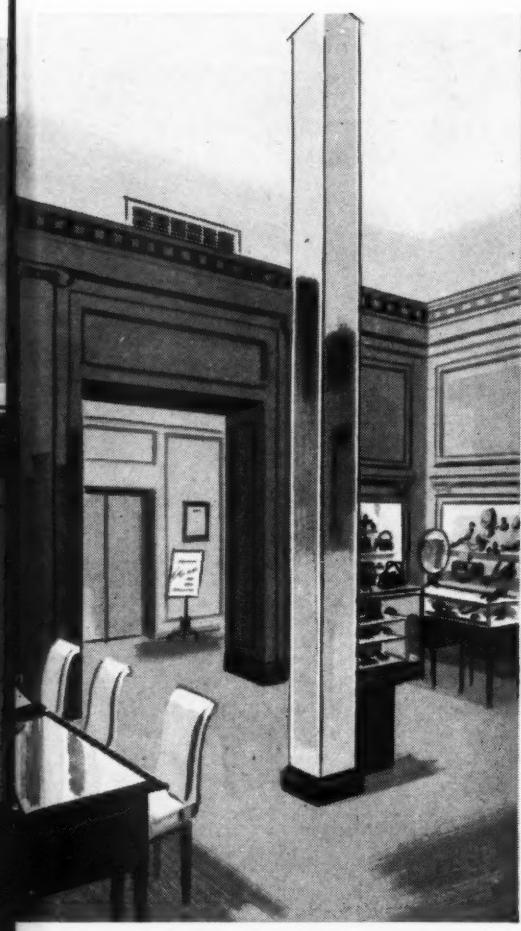
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▼ Carrier High-Velocity System is ideal for "interior zones."





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Carrier High-Velocity System (bottom left). Developed by Carrier primarily for the "interior zone" of stores and buildings. It features small cross-section ducts and conduits, all-around compactness, ease of installation, simplified maintenance, quietness, and great flexibility.

Carrier Zoning Weathermaker (top right). You can plan "departmentalized" air conditioning which gives each area of the store or building the climate it orders. Carrier Zoning Weathermakers will keep comfort constant in as many as 14 different zones, regardless of differences or changes in heat loads.

Carrier Air-Cooled Weathermaker (bottom right). It air conditions without water. Location of unit is not dependent on water supply. Fewer connections mean simplified installation. Maintenance costs are appreciably lower than for water-cooled models that require water-saving devices.

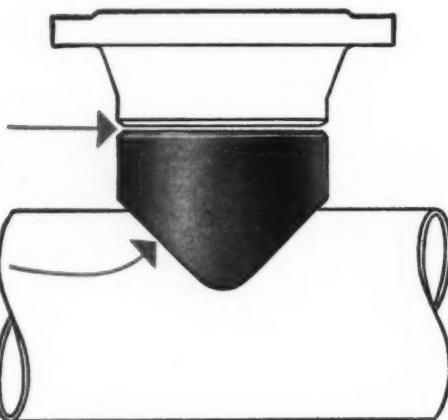
All Carrier equipment is engineered to the same high standard of quality. This means you can short-cut hours of selection by (1) using the Carrier line as your shopping guide and then (2) comparing values. Get in touch with your Carrier dealer or distributor—listed in the Classified Telephone Directory. Or write directly to us: Carrier Corporation, Syracuse, New York.

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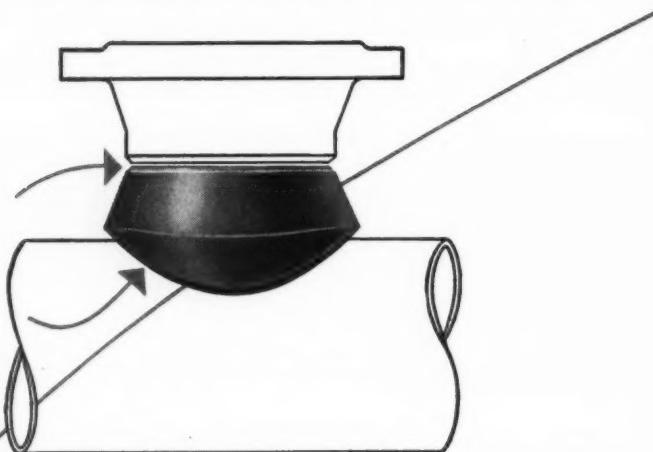
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must fit
must bevel
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registered, or qualified employed engineers under one general organization on a national basis, sectionalized into the various branches such as AIEE, ASCE, etc. each continuing its efforts to advance its membership by education, ethics, and social activities. The field is too broad for one organization to handle the specialized branches but the parent organization could take care of general organization (representatives of all branches being on the board of control), legal problems, national public education, Washington observation, and all matters of general interest to each of the branches.

ASME and AIEE, etc. would continue to function as they now do from a technical and social aspect. The combined membership of all would be aimed at one goal and we might do as well as the attorneys (American Bar Association) and doctors (American Medical Association). A small fee from a big membership would finance the parent organization and a fee adequate for branch requirements would finance the branch. . . .

Charles W. Burney
The Austin Co.
Cleveland Heights, Ohio

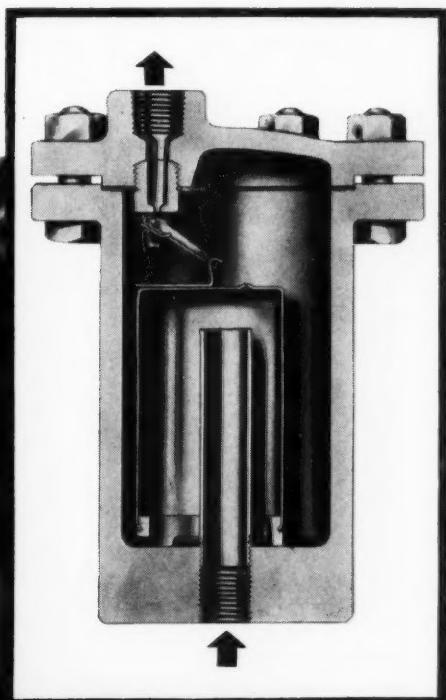
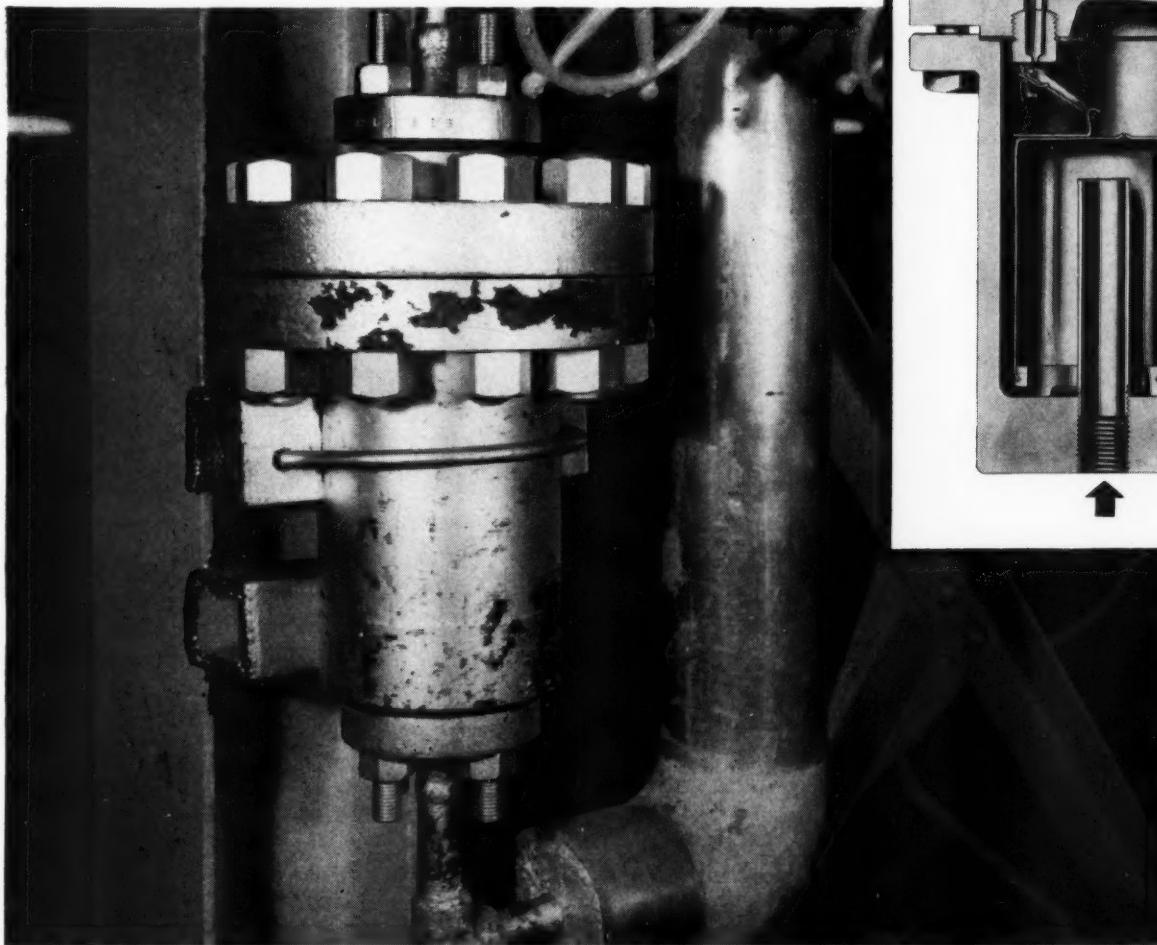
Dear Sir:

It is the writer's opinion that a national organization of consulting engineers will not be strong enough to stand alone and be effective. While admittedly somewhat hampered when affiliated with NSPE, the group could exert a much greater force nationally than in any other way. We already have far too many engineering organizations and another would be lost in the shuffle.

This organization could be formed with a separate financial supporting structure to encourage legislative action, to educate the public, and to handle the other requirements of the consultants' group. Employees of the consulting firms should definitely be included as a part of this organization since they are the consultants and key personnel of the consulting firms of the future and will necessarily be charged with upholding the aims of the group.

It is believed that the professional engineers will seriously consider a strong consulting group particularly if the alternative of a national consultant's group is brought to their attention and they are made to see the consequences of losing the consulting engineers' support. The Ohio Society of Professional Engineers is presently taking active steps to

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Up to 900 psi, 900°	ASTM Spec. F-1 carbon moly steel
Up to 2500 psi, above 900°	ASTM Spec. F-5 chrome moly steel
VALVE AND SEAT	Type 440 chrome steel, heat treated, standard. Stellite available.
LEVER MECHANISM	Stainless steel
BUCKET	Stainless steel
BOLTS	Class C high tensile, high temperature bolting material—125,000 min. tensile.
NUTS	Hex, semi-finish, heat treated for high pressure, high temperature service.
GASKET	Compressed graphited asbestos
INLET TUBE	Wrought iron



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FEBRUARY 1956

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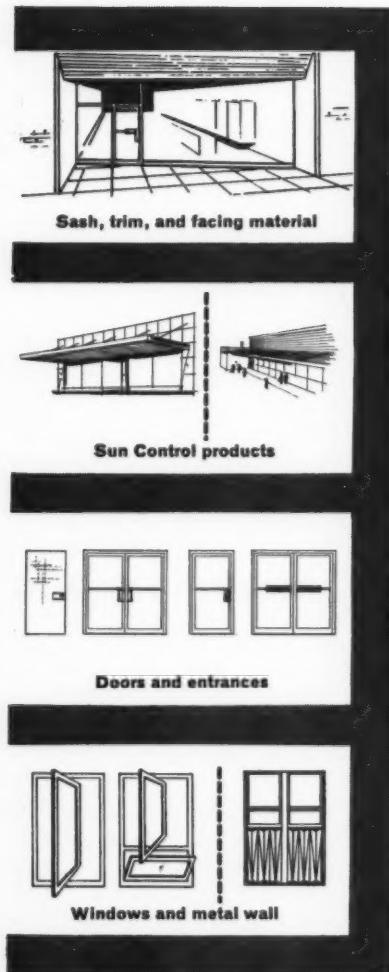
SEND FOR THIS LITERATURE:

1. Should we trap superheated steam lines? — the answers of 11 engineers who have used traps for this service.
2. Catalog J — complete data on forged steel traps and steam trapping.



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Throughout its 50 year history Kawneer has worked closely with architects in the development of architectural metals. The invention of resilient sash by the *architect-founder* of Kawneer revolutionized store design and retail merchandising. It was the foundation upon which many other architectural products were developed and manufactured over the years. Since the very first installation of Kawneer sash in the Johnson Department Store in Holdredge, Nebraska, in 1906, to the many thousands of modern store fronts and other buildings today with Kawneer doors, sash, trim, windows, metal wall and sun control products, compelling design has been the main consideration.

Pioneer in Aluminum Fabrication

The ability to give architectural metal products a certain "touch" has given Kawneer the opportunity to build products for all types of buildings. For example, Kawneer pioneered the use of aluminum for curtain wall construction and windows. Such notable buildings as the St. Paul Post Office, the Mellon Institute of Industrial Research and Boulder Dam Power House featured the famous Sealair windows and cast aluminum spandrels. Today, outstanding monumental edifices like the new, modern Tishman Building in Los Angeles and the Equitable Life Assurance Building in San Francisco feature metal wall construction by Kawneer. In the 30's, Kawneer was the largest aluminum window manufacturer in the U. S. The famous Sealair name was known as the ideal metal sash for home, office and factory. World War II stopped production of this window, but today it has returned again with outstanding features designed for the architect.

The great diversification of Kawneer architectural products and

the company's leadership in the field of store front design, to a great extent, is due to the cooperation between the architectural management of Kawneer and the practicing architect. When it became apparent that World War II was ending, Mr. Lawrence J. Plym, President of the Kawneer Company, engaged a leading architect to help develop Kawneer-advanced store front design theories.

By this time, Kawneer had had experience in working all of the commercial metals—copper, bronze, steel and aluminum. It became apparent that aluminum was the ideal architectural metal because of its attractive appearance, corrosion-resistance, light weight and workability.

New Store Front Concept Created

The ideas that the consultant architect and the Kawneer staff developed have since become criteria for the entire industry. Useless ornamentation, or "rococo" were eliminated. The intrinsic beauty of aluminum was accentuated in simple, functional metal design. The concept of the "open front" was advanced. It was believed that the desired effect of the full vision front would be attained when framed. As a result, many king-size trim-mouldings were introduced into the Kawneer line. The tremendously appealing flush glazing was developed. The result of this cooperation was the "K-47" line of architectural metals that have a professional design character, yet can be purchased out of stock.

Out of the post-war development came a new idea in aluminum facing. This is the product we all know today as ZOURITE. The consultant architect designed the profile of this facing while Kawneer engineers were experimenting with certain types of finishes. Although a regular alumilite finish

was in demand, a group of colors would make this product much more versatile. Many experiments were conducted with lacquers, baked enamels, paints and porcelain. None were quite satisfactory. Then, despite the low melting point of aluminum, Kawneer and DuPont pooled resources and for the first time, applied porcelain enamel to aluminum successfully to a production process. Today, Zourite is available in 10 different colors and a new additional profile has been designed that comes in pastel shades and alumilite. The color and profile combinations give the architect great versatility of design. Since the first Zourite, the use of color in architectural metals has become one of the major design focal points.

The K-47 line of architectural metals brought forth new concepts in store design. As a result of this research, many books were published to assist the architect. Illustrations developed at great expense are still available to act as guideposts.

In Constant Touch with Architects

The interest in new products grew to an enthusiastic pitch as a result of the immediate post-war development. Kawneer's Research and Development Department grew by leaps and bounds. The size necessitated formal working agreements with architectural firms. These firms act as consultants by establishing design criteria for proposed projects. They help in specifying the desired features, functions, size and modular requirements. Throughout the development period, the solutions to these requirements are reviewed by practicing architects.

To round out the development work in relation to the architect's needs, an architect with a heavy background in architectural research is retained on the Kawneer staff. He is concerned with desirable sizes and modular standards. He works with a group of the more prominent architectural firms so that their thought is brought into the design considerations.

Finally, Kawneer makes sure by surveying a large cross section of architectural firms during the forma-

tive stage to gather opinions and demands. If you have seen the phrase "Demand-Designed" in regard to a Kawneer product, this survey technique is the reason why.

After 50 years of close cooperation with architects, Kawneer can truthfully claim to have always been in "touch" with the profession and construction industry. Today the line has greatly diversified to include metal wall, flush doors, sun control products and other assemblies for big buildings, little buildings, stores, offices, factories, schools, et al. The organization has grown to include 12 factories and warehouses, over 110 salesmen covering the U. S., Canada and Latin America, and more than 1200 factory-trained dealers. From research to the installed metal, Kawneer devotes itself to the needs of the architect.

HOW YOU BENEFIT TODAY FROM THE KAWNEER TOUCH

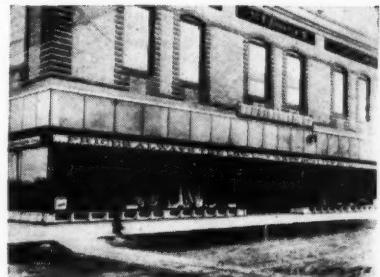
- Good workmanship by skilled artisans for better-looking buildings.
- Extensive and modern production and warehouse facilities to insure prompt delivery.
- Research and development section cooperating with architects, to design new products for the construction industry.
- Thoroughly experienced engineers to provide precision products for quick and accurate erection.
- Nationwide company sales force for immediate counsel and service.
- Large factory-trained dealer organization for quality installation to conform to specification and design.

NEW PRODUCTS to commemorate 50th Anniversary

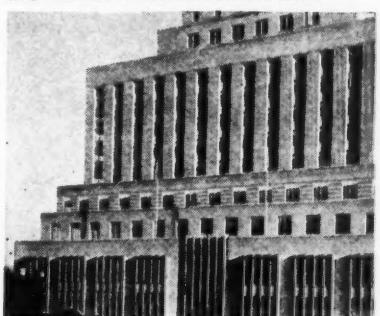
Kawneer maintains an extensive Research and Development program to contribute new products to the construction industry. Very soon, a number of new products will be announced in commemoration of its 50th Anniversary. Look for the announcement in the coming issues of this magazine.



*foremost fabricator of
aluminum and plastics for
the construction, aircraft and appliance industries*



The first truly modern store front with large display windows in Kawneer resilient sash.



The St. Paul Post Office and Customs House features Kawneer windows and spandrels.



The modern Tishman Building in Los Angeles features Kawneer Metal Wall including specially constructed louvers.



The modern store front of today represents the new "open front" concept for greater merchandising effectiveness.



The beautiful new Long Island Jewish Hospital, New Hyde Park, L. I., N. Y., Louis Allen Abramson, Architect; Eugene D. Rosenfeld, M.D., Consultant and Executive Director; Slocum & Fuller, Mechanical Engineers; Jarcho Bros., Inc., Mechanical Contractors; Turner Construction Co., General Contractors.

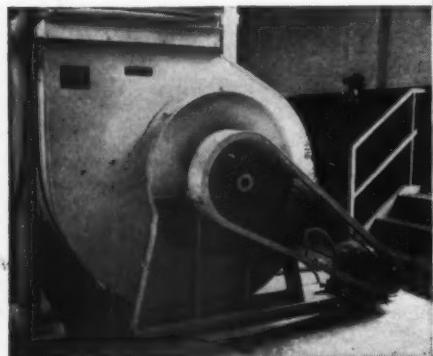
A GOOD REASON FOR SPECIFYING "Buffalo" VENTILATING FANS!

A hospital, of all buildings, needs quiet mechanical equipment. That's why, in the brilliant planning of this new Long Island Jewish Hospital, ventilating fans were chosen which would not only deliver to complete satisfaction, but do it at an extremely low noise level. Thus, "Buffalo" Fans were specified as part of the hospital's unique ventilating and air conditioning system.

In summer, cold well water is circulated thru radiant panel piping and thru "Buffalo" "PC" Air Conditioning Cabinets in the ventilation system. In winter, fans supply warm air which, in conjunction with the radiant panel heating system, provides adequate comfort throughout the hospital.

For your air requirements, choose the fans that so many hospitals, institutions, commercial and industrial firms choose for quiet operation — efficiency — dependability — in short, for "Q" Factor* performance.

Below, one of the super-quiet "Buffalo" Limit-Load® Fans keeping operating rooms of the hospital dependably ventilated. Write for Bulletin F-101 for details on this proved line of fans.



*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.



Above, a group of "Buffalo" Belted Vent Sets are used for exhausting and Limit-Load® Fans supply clean, tempered air to hospital service areas.



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FORCED DRAFT COOLING HEATING PRESSURE BLOWING

foster a strong consulting faction with separate financial support . . .

Jack N. Steketee
Samborn, Steketee & Assoc.
Toledo, Ohio

Dear Sir:

... As most engineers will agree, the greatest single weakness of the engineering profession is the fact that we have too many different engineering organizations, each of which is very desirable, but since they are separate they cannot co-ordinate their efforts. Therefore, I feel that, in general, forming new engineering associations is not a desirable policy.

In my opinion, a concerted effort should be made by the members of all engineering associations to form one coordinated association with committees or sections in this association to handle special requirements of special groups. My present thinking is that the various state societies of professional engineers are the organizations at the state level that could most logically represent all engineers and that the National Society of Professional Engineers could coordinate the activities of the individual state societies.

Robert E. Briggs
Consulting Electrical Engineer
Jackson, Miss.

Dear Sir:

Nothing would please the unions better than to see the consultants in an organization of their own. The unions could then point to them and say to the employed engineer, "your bosses have organized, so now, for self-protection, you must organize—and we'll do it for you."

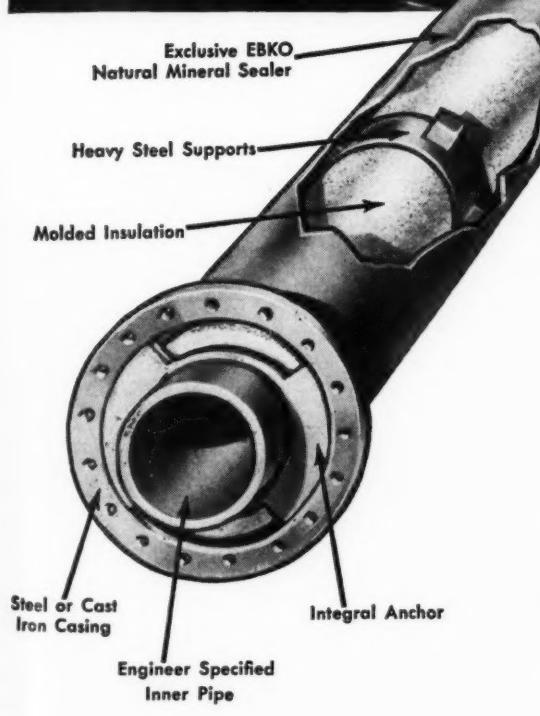
The profession now has too many splinter societies, each thumping its chest and proclaiming loudly (but ineffectively) that it is the protector and spokesman for the profession.

The profession and the Professional Society need the prestige of the consultants.

The consultants need the membership of the Professional Society and the moderating influence of that membership. Working within the Society, the consultants would have to moderate their immediate desires to the desires of the professionals as a whole (as represented in the Society), but would benefit by the backing of the large and diversified membership. . . .

Winfield A. McCracken
Consulting Engineer
Houston, Texas

Another reason why
EBKO *is best for underground piping...*



Never has an EBKO System Failed!

Over 1,000 miles of EBKO piping has gone underground since the first system was installed. The durability of this prefabricated piping system has been tested by these installations and has proven worthy of full investigation prior to the purchase of any system . . . because, never, to our knowledge, has an EBKO system failed.

What Is This Reason For The Superior Durability Of An EBKO System?

Simplicity . . . high quality component parts . . . improved design . . . inherent strength . . . and other factors add up to a system that is safe for any type soil. It can be completely submerged in water without deterioration for many, many years.

Each of the six component parts are held to the most rigid specifications. The simplicity of design allows EBKO to keep the quality high and yet keep the cost down.

This system costs no more initially than other prefabricated piping systems and saves money on installation and maintenance.

Complete details on this system may be had from local EBKO representatives or by writing to the factory—no obligation of course.



EBKO
Underground and Overhead
Prefabricated Piping Systems

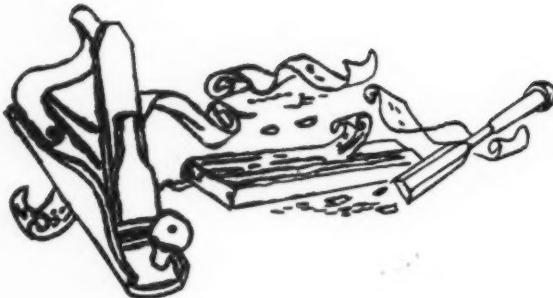
For STEAM • CONDENSATE • HIGH TEMPERATURE and CHILLED WATER • REFRIGERANTS • GASES • ETC.

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SCRAPS & SHAVINGS

THERE IS DANGER of a serious break between those consulting engineers who are avid supporters of the Functional Group plan of the National Society of Professional Engineers and those consulting engineers who are promoting a National Federation of the State Societies of Consulting Engineers. The survey conducted last month by CONSULTING ENGINEER shows that about 52 percent of the engineers in private practice are now members of NSPE. The same survey showed that 76 percent of those same engineers feel that the State Associations of Consulting Engineers should form a National Federation, and a very large majority of the consultants in states where there are currently no State Associations think such groups should be formed as soon as possible.

Many of the most active members and officers of NSPE are opposed to the idea of separate associations for consulting engineers, and they are convinced that the proper approach is for consultants to activate functional groups in their State Societies of Professional Engineers and operate within the framework of NSPE. They think that any association formed strictly for engineers in private practice would further divide the whole engineering profession and make unity that much more difficult.

On the other hand, the majority of consultants seem to feel that they need state and national associations to deal with their own particular problems as engineers in private practice. To be quite blunt, these engineers want something close to a management association — a group dealing primarily with problems involving the financial well-being of the private practitioner. As these men see it, this is a job that has to be done solely *for* the consultants, and therefore it should be done solely *by* the consultants.

They point out that a large percentage of the engineers who are members of NSPE are employee engineers in industry. The large percentage of the consulting engineers are employers or at least top management. While the goals of both are the same so far as the over-all development of the profession is concerned, their aims may be quite different when it comes down to basic business problems. Therefore, all engineers, those in industry and those in private

practice, should belong to one Society of Professional Engineers, but, they say, this does not mean that engineers in private practice should be kept from associating themselves in a group designed to promote the interests of their own privately owned businesses.

In general, then, NSPE opposes the idea of consultants forming an association because it will be "yet one more engineering organization." But the backers of the consultants' associations still feel that NSPE is a worthy organization to which all engineers, including consulting engineers, should belong. This is not a new attitude, it is just that it is now visible on a larger scale. The same condition existed a few years ago in Oklahoma when a number of Oklahoma consultants formed an association outside of the OSPE. It was thought then, by the staunch members of OSPE, that this was a break that would separate the consultants from all other engineers. It turned out differently. Instead, the consultants maintained their membership in OSPE and even helped increase its membership. They worked as officers and committee members of OSPE on all problems affecting engineers as a whole. They worked within the new Oklahoma Association of Consulting Engineers only on those problems that involved engineers in private practice. The result was a logical arrangement that worked to the benefit of both groups.

Very much the same thing happened in Minnesota. Then, with the formation of the Missouri Association of Consulting Engineers, last summer, the founders went so far as to put into their by-laws a stipulation that to be a member of the Association, one would have to also be a member of MSPE.

It is hoped that with the formation of a National Federation of Consulting Engineers, the history of the Oklahoma and Minnesota Associations and their relations with their State Societies of Professional Engineers can be repeated on a national scale.

It seems to us that if the Steering Committee of the National Federation sets the organization up in such a way that firms rather than individuals are members, and they clearly define the aims of the Federation, it will soon be clear that there is here no effort to usurp or dilute the excellent work of the National Society of Professional Engineers. ▲ ▲

PERFORMANCE VERIFIED / by acid test

Even before a Powell Valve is made, it must pass the acid test. For quality control of Powell Valves begins not with manufacture—but with the very materials which go into Powell Valves.

Constant laboratory control is one of the many ways we make certain that Powell Valves will give dependable flow control. Another is the final step of manufacture of these precision-built valves: *every Powell*

Valve is subjected to an actual line test.

Because of Powell's painstaking quality control, valve repair is cut to the minimum and plant shut down through valve failure is substantially reduced. Records of performance the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our **COMPLETE quality line** which has PERFORMANCE VERIFIED.

The Wm. Powell Company, Cincinnati 22, Ohio . . . 110th YEAR



FIG. 3003 WE—Steel Gate Valve
For 300 Pounds W.S.P.



FIG. 11365—Steel Pressure Seal
Horizontal Lift Check Valve
For 1500 Pounds W.S.P.

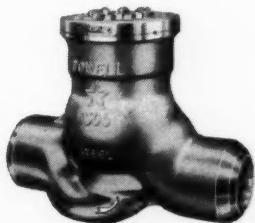
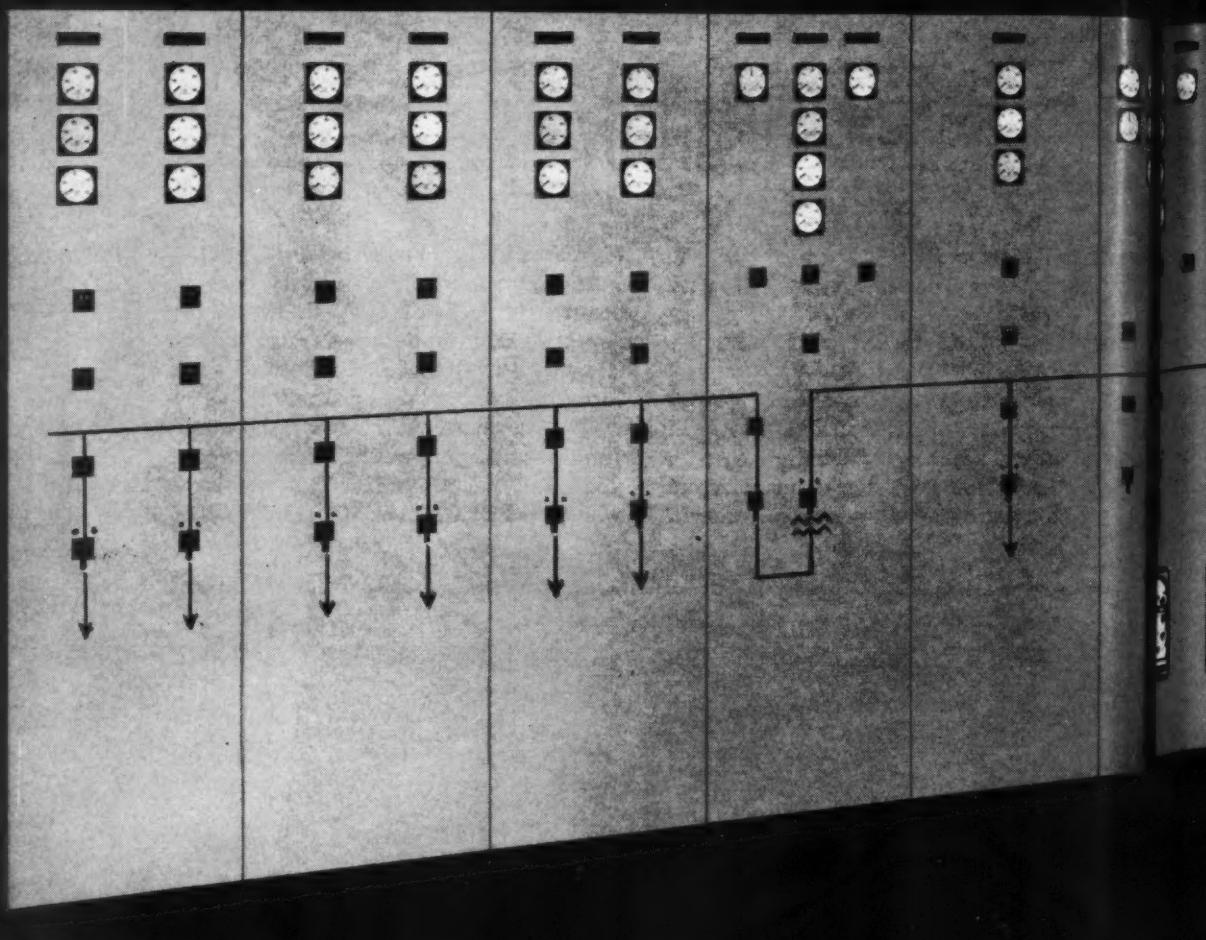


FIG. 11323—1500-Pound Motor
Operated Steel Pressure Seal
Gate Valve.



POWELL VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES.



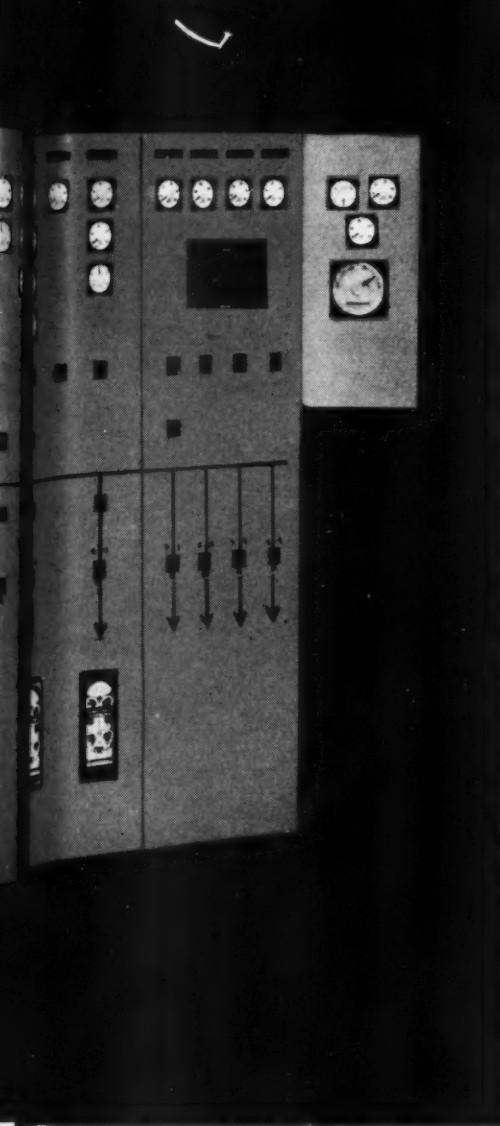
General Electric introduces... a new concept in

FUNCTIONAL BASIC CIRCUITS

1. A-C Feeder with Overcurrent Protection
2. A-C Feeder with Directional Overcurrent Protection
3. Power Transformer
4. Tie Line with Wire Pilot Differential Protection
5. Transmission Line with Carrier Current Directional Comparison Protection
6. Transmission Line with Directional Distance Protection
7. Small A-C Generator
8. Large A-C Generator
9. Unit Generator—Transformer
10. Bus Differential Protection
11. Synchronizing Equipment

Selecting the Functions Designs the Switchboard

These eleven basic circuits cover applications for the great majority of switchboard users. After the functions of the board are selected, it is only necessary to select the desired options from standard specifications for complete physical and electrical design of the switchboard. The model shows the attractive physical arrangement of the components on the control side of a basic circuit switchboard. Similarly, devices on relay side are lined up both horizontally and vertically to meet modern appearance design requirements. Components of a circuit group on control and relay sides are arranged directly opposite each other for operating simplicity.



BASIC CIRCUIT SPECIFICATIONS

Transmission Line Circuit Equipment

(With directional comparison protection)
(REACTANCE TYPE) OPERATED OVER CARRIER CHANNEL

BASIC

- 1-Ammeter, indicating
- 1-Switch, 3 phase ammeter transfer
- 1-Switch, circuit breaker control, indicating lamps
- 1-Switch, carrier cut-off
- 1-Switch, carrier test
- 1-Milliammeter, d.c. indicating
- 1-Phone jack with white lamp

ONE LINE DIAGRAM

No. 79CO No. 94

OPTIONAL

- 3-Ammeters, indicating
- 1-Wattmeter, 3 phase indicating
- 1-Voltmeter, 3 phase indicating
- 1-Meter, synchronizing
- 1-Switch, reclosing relay cut-out
- 1-Lamp, white, indicating (disagreement)
- 1-Lamp, white, indicating (line potential)
- 1-Mimic bus
- 1-Relay, automatic reclosing, 3 adjustable reclosures No. 79
- 1-Set of transfer trip devices (sending)
- 1-Relay, auxiliary, mounted on back of panel No. 94

1-Switch, carrier
 2-Lamps, amber and red
 For 3 terminal (tapped) lines
 Omit 1-Relay, impedance and
 Add 1-Relay, carrier blocking
 Add 1-Relay, out-of-step block

32

Each of the basic circuits can be quickly designated from functional specifications.

switchboard design

General Electric has recently announced a new "basic circuit" concept in switchboard design. Developed by the Company's Medium Voltage Switchgear Department after extensive research with users of switchboards, this new approach *applies basic circuits — pre-engineered and time-tested functional circuits — to the design of switchboards*. Each basic circuit includes all instruments, meters, control devices and relays necessary to perform the desired function.

This new development offers high quality custom switchboards from "Building-Block" basic circuits.

Important advantages are:

1. Switchboard operators can easily visualize circuit arrangement.
2. Reliable time-tested circuits.
3. Long hours of detail planning saved.
4. Reduced over-all procurement effort and time.
5. Determine size of switchboard before ordering.

For detailed information about this latest switchboard development write for Bulletin GEA-4127, General Electric Company, Schenectady 5, N. Y. 511-13

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GENERAL  **ELECTRIC**



E. F. MacDonald

INDUSTRIAL ECONOMIST

ECONOMIC News Notes

tain with sufficient elevation and the proper geological formation for low-cost excavation."

► **NORMAL BOOM**—Citing problems that will be met along the way, Mr. T. S. Holden, F. W. Dodge Corporation, feels that "if all goes well," there may "easily" be \$450 billion worth of new construction put in place in the next decade. Incidentally, Dodge is publishing again, for the first time since 1942, its Building Business, a monthly bulletin of information on construction trends and related subjects.

► **TEXAS-SIZE**—Stating, "We plan to make this portion of Texas the most important light-industry spot in the nation," Mr. W. Zeckendorf, president of Webb & Knapp, announced plans for a large urban industrial development in the Dallas-Ft. Worth area. Reported to eventually include over 4000 acres, the site will offer a transportation advantage in the form of the Dallas-Ft. Worth toll road now under construction.

► **MORE POWER**—Electric utilities will reverse the trend of the past two years and increase aggregate outlays for new plant and equipment this year, according to estimates of the Edison Electric Institute. Joint estimates of the Departments of Commerce and Labor, however, indicate a decline of 6% this year for new construction by private electric utilities. The Institute looks for construction outlays to average about \$3 billion annually over the next ten years.

► **INDUSTRIAL CONSTRUCTION**—A survey of a large number of metalworking plants by Steel, the metalworking weekly magazine, disclosed that 15% of all plants expect to construct new facilities this year and that 40% expect to build additions to existing plants. Metalworking executives look for the dollar volume of such sales to rise 8% above 1955, with price increases accounting for only a part of the gain.

► **THROUGH-THE-TRANSIT**—A 38% increase in capital spending in the Pittsburgh area (four counties) is looked for this year by the Business Research Bureau of the University of Pittsburgh. . . . Note the excellent selling job Employers Mutuals of Wausau has been doing for the city of Wausau, Wisc., by way of its interest-filled ads. They spell construction eventually. . . . 1955 was the second consecutive year of decline in awards for hotel construction. . . . A 25% rise in acoustical building materials this year is predicted by the Acoustical Materials Assoc. . . . Two Italian companies beat out American and European bidders for the contract to build a \$170 million steel mill for the oil-rich Venezuelan government. . . . The segregation issue may be a block to enactment of legislation for Federal aid to school construction.

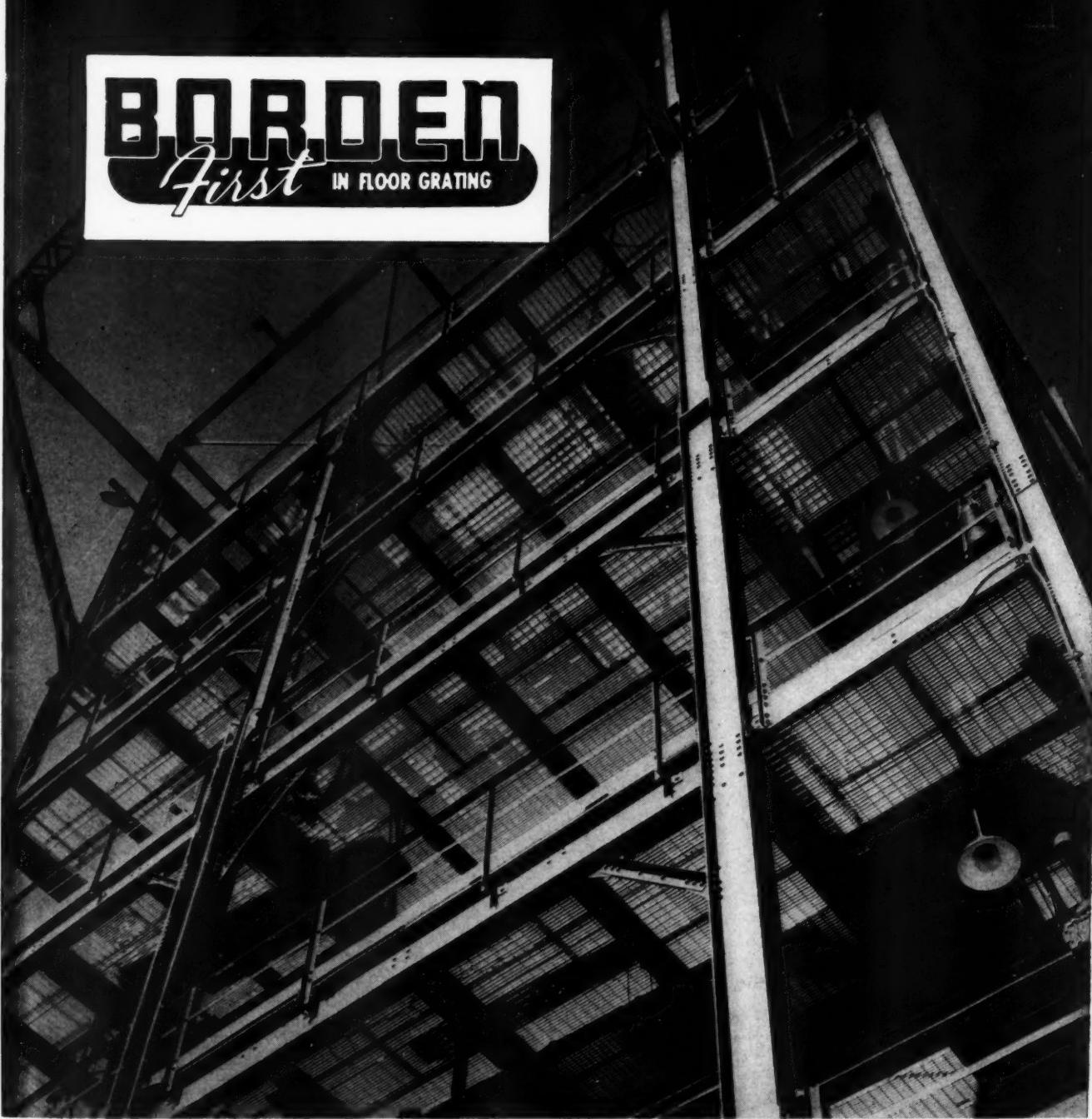
► **BOOM AHEAD**—Corroborating earlier forecasts that 1956 would be another record-year for the construction industry, Mr. Roy Wenzlick, real-estate analyst, stated in a speech last month that an increase in commercial and industrial construction should more than offset a slight drop in residential building. Pointing out that there will be a material increase in the number of persons reaching marriageable age in the decade of the Sixties, he looks for a new housing boom of substantial proportions at that time.

► **LUMBER RESERVOIR**—Estimating demand for new dwellings will rise to 2.2 million units by 1975, Timber Resource Review, published by the Forest Service of the U.S. Dept. of Agriculture, points out that the derived demand for lumber supplies will fall heavily on the South. This region leads the nation in its saw-timber growth and has a practically unlimited potential timber supply.

► **BETTER MOUSETRAP**—The United Aircraft Corp. found that a major reason for its typical difficulty in hiring and holding engineers and skilled technicians was the absence of a nearby college where engineers and scientists could continue or complete their education while on the job. So the company brought the hill to Mahomet—it persuaded Rensselaer Poly to set up a graduate school in the neighborhood of the plant, utilizing a revamped shopping center. United Aircraft picks up the tuition tab for its worker-students. The latter have work-school schedules permitting them to obtain a Masters degree in 2½ years. The school is open to employees of any company and has attracted the active interest of a number of other concerns in the area.

► **SECURITY AND ECONOMY**—The American Machine & Foundry Co. is studying the feasibility of constructing an underground plant on a location near Huntsville, Ala. The company is considering estimates indicating that costs of constructing and maintaining an underground plant would be lower than they would be for an orthodox plant of similar size. The site, on which AMF holds an option, was chosen to provide "a moun-

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IN FERROUS AND NON-FERROUS METALS

BORDEN ALL-WELD DESIGN

The best type for use where floors are subject to extreme corrosion or moisture — chemical plants, breweries and other process industries. There are no cracks, open joints, or holes in bars. This type made only in mild steel.

BORDEN RIVETED DESIGN

Most substantial and oldest design of grating made, permits perfect distribution of loads. Made on the truss principle, Borden Riveted Gratings are hydraulically power-forged for strength and durability. Particularly recommended for aluminum.

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Neat, clean, durable, easy to paint and maintain. Pressure Locked Design permits maximum passage of light, heat and air. It is especially desirable in power plants, boiler rooms and all dry area. Deep cross bars increase lateral support.

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817 GREEN LANE Elizabeth 2-6410 ELIZABETH, N. J.
SOUTHERN PLANT -- LEEDS, ALA. — MAIN PLANT—UNION, N. J.

ATOMS IN ACTION

"RADIATION STERILIZED foods taste, smell, and look terrible," said Dr. Leonard Reiffel, supervisor of nuclear physics at Armour Research Foundation, in a year-end statement on progress in the atomic energy field. As more feasible at the present time he cited radiation pasteurization—killing most, but not all, of the bacteria. This requires less radiation, does not destroy food quality, and still lengthens storage life under refrigeration.

THE FIRST LUMP-SUM contract to build reactor fuel elements in a privately owned facility has been awarded to The Babcock & Wilcox Co. by AEC. Contract calls for 325 fuel element assemblies to replenish the core of the Materials Testing Reactor at Arco, Idaho, operated by Phillips Petroleum Co. for AEC.

SITE WORK has begun at ALCO Products' new nuclear laboratory at Schenectady, N.Y. The reactor facility will be used for experiments in connection with ALCO's contract for design and construction of the Army Package Power Reactor. Called zero power experiments, the tests will employ fuel elements to be used in the Army plant, but power level will be kept down to one watt.

THE SEVEN TO NINE MILL per kwh power cost for nuclear power stations seemed far away when Rear Admiral H. G. Rickover told a meeting of industrialists that, "with conservative contingencies and minimum specified performance," the cost of power from the Shippingport PWR plant will be 52 mills per kwh, assuming a load factor of 80 percent and a plant capacity of 60,000

THE CANTON REPOSITORY Page 11

Canton Stoker Buys Wagener Steam Pump

**69-Year-Old Firm
Will Be Operated as
Division of Purchaser**

Canton Stoker Corp. has purchased the assets of the Wagener Steam Pump Co. of 1101-8th st SW, which has been a manufacturer of piston type steam and power pumps for 69 years.

Wagener pumps are designed to operate either with high pressure steam or electric motor drives. They are used for a wide variety of purposes.

Some are used to pump shampoos, detergents, soap, tooth paste, fuel oil, water, mashed potatoes and chemicals from one point to another.

To Be Major Supplier

Dubs said the addition of the Wagener Steam Pump division will establish Canton Stoker as one of the major suppliers of boiler room equipment in this country.

Canton Stoker produces a com-

to be known as . . .

Wagener-Schrader Pump Div.
CANTON STOKER CORP.



"Wagener" STEAM PUMPS

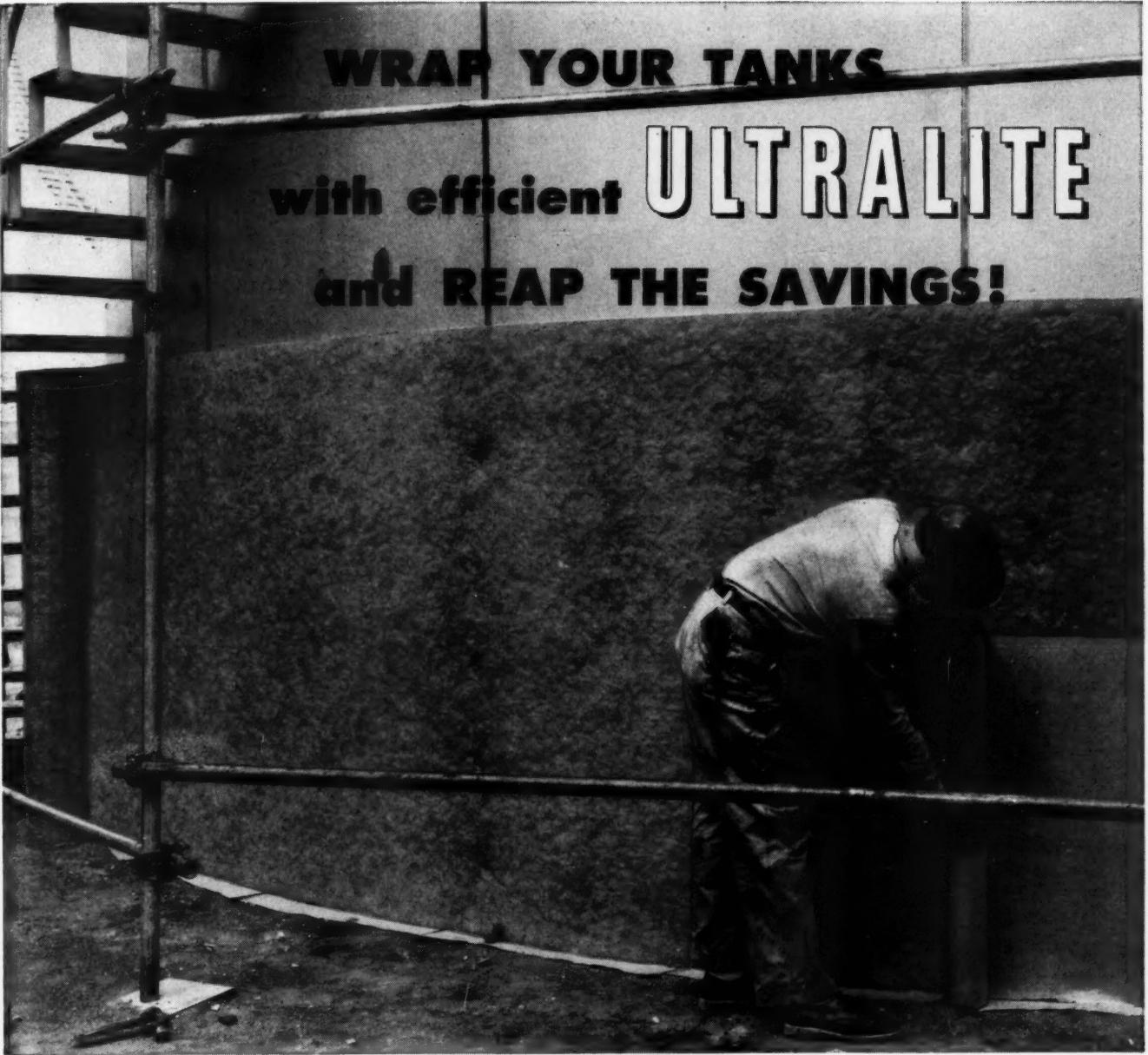


**"THE RIGHT PUMP
TO DO THE JOB BEST"**

"Schrader" POWER PUMPS

CANTON STOKER CORPORATION

Specialists in Automatic Coal FIRING, HANDLING and CONTROL Equipment
425 ANDREW PLACE S. W. • CANTON, OHIO • PHONE GLendale 2-8123



**WRAP YOUR TANKS
with efficient **ULTRALITE**
and REAP THE SAVINGS!**

Quick as a flash, lightweight rolls of Ultralite glass fiber insulation can be run around tanks, vats and vessels — and that's more than half the battle in your war on insulating costs. The wider the roll, the quicker the job is done, and Ultralite is available in rolls up to 10 feet wide!

Consider the advantages of this New Way vs. the Old Way on a tank of about 4,000 sq. ft., like the one pictured. To do the job with Ultralite required just 4½ rolls, 150' long and in this case, 6' wide. One man can easily carry such a roll. One man can easily apply Ultralite. But, if you were to use individual insulation bats, 24" x 96", you'd need 250 bats . . .

and how many men would you say? And while you're figuring the saving, don't forget that you need twice as many welded mounting clips to apply bats as you do to apply Ultralite blankets.

Versatile and efficient Ultralite has other advantages, too, as insulation for all types of large heated equipment. It's resilient — not rigid — so that it can't crack under normal expansion and contraction. Its superior thermal efficiency means substantial heat savings over the years, and of course, Ultralite is as permanent as glass itself.

Next time, use Ultralite. *It figures.*

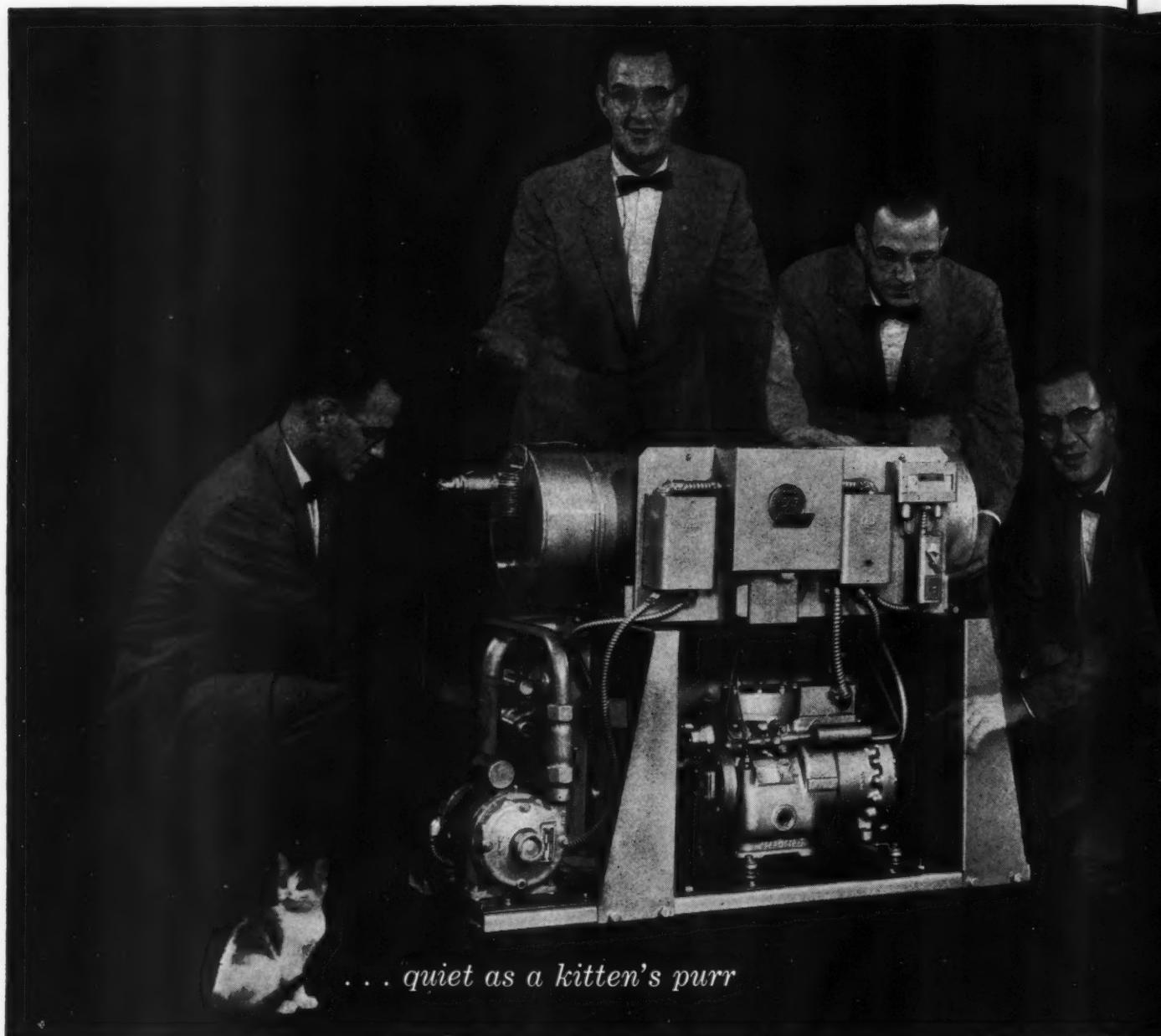
WRITE TODAY FOR "HOW-TO-DO-IT" DETAILS AND SPECIFICATIONS

GUSTIN-BACON

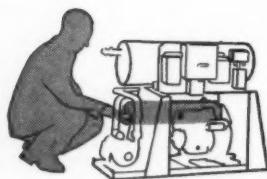
Thermal and acoustical glass fiber insulations • Pipe couplings and fittings • Molded glass fiber pipe insulation

212 W. 10th St., Kansas City, Mo.

GUSTIN-BACON Manufacturing Company **gb**
BACON



... quiet as a kitten's purr



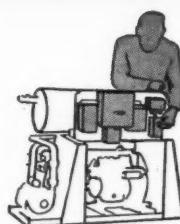
Model S *Acme* Condenser — maximum heat transfer, minimum size

Acme's integral fin tubing and compact coil design puts extra heat transfer capacity in a size of condenser that adds to Flow-Cold's compactness.



The *Acme DRY EX*®— recognized leader in the chiller field

Dry-Ex design puts extra chilling capacity in every inch of chiller space. Dry-Ex tubes are electronically rolled into the tube sheet openings — no internal joints, no trouble on the job!



Accurate controls match unit operation to the load

All necessary controls are furnished to give fast, accurate response to system requirements. Compressor operates only when needed: power consumption and wear are minimized.

A product of Acme Industries, Inc.—Manufacturers of Quality Air Conditioning & Refrigeration Equipment

Acme's new *FLOW-COLD*

today's most advanced packaged chiller in the 3 thru 20-ton range

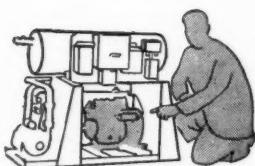
Acme's research and development men have done it again: Significant improvements in design and better-than-ever quality have been built into the new Flow-Cold to make it today's most advanced small-tonnage packaged liquid chiller. No new position, this — since introduced in 1950, the Flow-Cold has been the industry's most widely used packaged chiller.

BALANCED, PROVEN COMPONENTS. Acme takes components that are individually tops in their fields, selects the exact capacities needed for real efficiency and economical operation, and assembles them in a compact package. That's the Flow-Cold — you can't buy better!

EVERY FLOW-COLD FACTORY TESTED. Every Acme Flow-Cold unit is fully charged, tested and operated under actual load conditions before shipment.

SIMPLE TO INSTALL AND OPERATE. With over 36 years of Acme field experience to draw from, Flow-Cold engineers design these packages with the contractor and user in mind. Fast, easy connections — trouble-free operation!

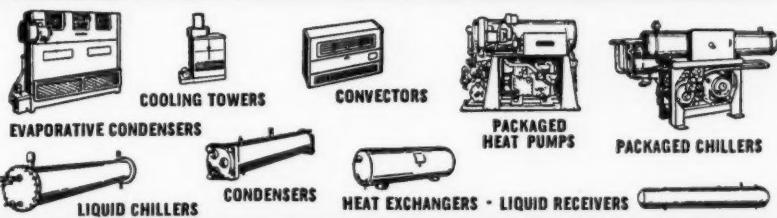
For packaged chiller capacities from 20 thru 300 tons, investigate the versatile Acme Flow-Therm. Standard or custom packages to fit your needs.



Advanced design Acme
Compressor — precision-
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dependable operation

New, accessible hermetic-type compressor has aluminum pistons — is dynamically and statically balanced for quiet, vibration-free performance.

Refrigeration Equipment since 1919



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City..... Zone.....

State.....

kw net. Reason for the high cost was given as the degree of flexibility built into the plant and duplication of certain types of equipment to accommodate reactor cores of different types and sizes. About ten years from now, AEC plans to use an advance 90,000 kw core which should give electricity at 14 mills per kwh.

DEADLINE for applications for the 1956-57 session at the Oak Ridge School of Reactor Technology is March 12. Inquiries should be addressed to F. C. VonderLage, Director, Oak Ridge School of Reactor Technology, Union Carbide Nuclear Co., P.O. Box P, Oak Ridge, Tenn.

BROOKHAVEN National Laboratory's medical research center and reactor have been given the green light by AEC. The reactor will be designed specifically for medical utilization and will make available a source of neutrons for experimental work on brain cancer, and a supply of special short-lived radio-isotopes. The reactor type will be settled in "one or two" months. One type known to be under consideration is a 1000 kw reactor using swimming pool type fuel elements. Eggers & Higgins, of New York City, has the contract for design and construction supervision of the hospital, laboratory, and reactor building.

THE ATOMIC ENERGY COMMISSION plans in the near future to open a Document Room in its building at 1717 H St., N.W., Washington, D.C. All publicly available documents related to AEC's licensing, regulatory, and access permit programs and copies of licenses, construction permits, access permits, comments on proposed regulations, and similar data, except those classi-

fied for security reasons or which would adversely affect the interest of a person concerned, will be on file in the room. No security clearance will be required.

INTERNUCLEAR CO., a new organization formed to provide consulting and design services in all aspects of reactor development, is made up of almost half the members of Monsanto Chemical Company's former atomic power project staff. Dr. Philip N. Powers, former head of Monsanto's project, is president of the new group. The chemical company lost interest in power reactors when AEC rejected a proposal for a dual-purpose reactor, the basket in which Monsanto had all its eggs.

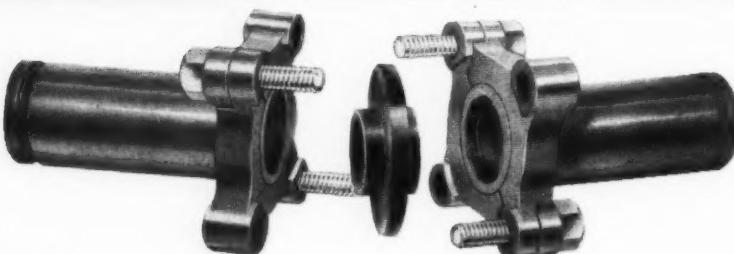
CLARK, HITCHCOCK & ASSOCIATES have announced plans for a Microform Publishing Div. to sell microcopies of AEC unclassified and declassified documents. The complete set of some 10,000 documents is priced at a pre-publication price of \$2100. Information is available from CH&A offices at 1115 17th St., N.W., Wash., D.C.

RAYTHEON Manufacturing Co. has compiled a data chart listing about 100 reactors built, under construction, or planned, here and abroad. Where available, basic information on each reactor is included. For copies write to Nuclear Power Group, Research Div., Raytheon Manufacturing Co., Waltham 54, Mass.

A FOOD IRRADIATION CONTRACT covering electron accelerators, radioisotopes, used reactor fuel elements, direct nuclear reactor radiations, and radiation from reactor coolants has been awarded to North American Aviation by the Army Quartermaster Corps. ▲▲



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SIMPLIFIES YOUR PIPING PROBLEMS . . .**



The GACO split flange is the ultimate in engineering simplicity. Pipe is prepared for joining by grooving ends and counterboring rubber lining. Rubber gasket is fitted into the pipe ends. Split flanges are wrapped around grooved pipe section and bolted together to complete the assembly of the GACO joint. The GACO System is adaptable to any type of rubber-lined pipe installation.

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Rubber-lined pipe can be cut to size and installed at the job site from a sketch of the installation.

2. 360° ROTATION . . .

Flexibility of the free turning GACO split flange principle assures that every installation will line up on the job. The GACO flange hole pattern rotates around the pipe, conforming to all standard, rubber-lined fittings.

3. FOUR WAY SEALING . . .

GACO rubber gasket has a four-way sealing feature, giving leakproof service up to 1600 pounds pressure and 28" vacuum.

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The GACO joint presents uninterrupted flow to the liquid stream through the entire GACO pipe system.

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For applications which formerly required larger and more expensive equipment, you can now use the new I-T-E "M" frame molded case circuit breaker without sacrifice of quality. It offers optional pressure connectors for double or triple cable connections per phase contained within the circuit breaker case. Exclusive 3" pole center design dimensions permit easy accessibility for front cable or rear bus and stud connections. And the "M" frame breaker is ideally suited for use in panelboards, power panels, switchboards, motor controls, bus duct plugs, and individual enclosures.

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Triple cable connectors accommodate three 300-400 mcm cables per phase.

Optional double cable connectors accommodate two 400-500 mcm or 600-700 mcm cables per phase.



I-T-E CIRCUIT BREAKER COMPANY • Small Air Circuit Breaker Division



the Legal Aspect

MELVIN NORD

Consultant in Legal and Technical Problems

Registered Professional Engineer

Patent Attorney



Stream Pollution and Riparian Rights

LEGAL LIABILITY for the pollution of streams may be predicated on any of three grounds: nuisance, riparian rights, or statutory prohibition. We have considered the problem of nuisance. Here we will consider the subject of riparian rights as it affects the problem of stream pollution.

The law of riparian rights is a part of the law of real property, and is of a relatively technical nature. Riparian rights are the rights to the use and enjoyment of the water by the possessors of land adjoining streams. Since there are many riparian owners, it is obvious that no one owner will ordinarily have the exclusive right to the use of the water, for each riparian owner must have similar rights. The basic legal problem is the apportionment of these rights among the various owners.

The definition ordinarily given for riparian land is land that borders on a natural stream or through which a natural stream flows. A riparian proprietor is a person in legal possession of riparian land: the owner or tenant.

Borderline questions arise as to whether or not the status of riparian proprietorship exists. An example of this is where part of a municipality borders a stream. The question raised is whether the municipality should be regarded in its entirety as an individual entity, having in its corporate capacity the rights and liabilities of a riparian proprietor. While there is no doubt that the city is a riparian proprietor as to such lands as it owns that border the stream, it is sometimes important to decide whether other lands, which do not border the stream but which are part of the city, are also to be considered as a part of the city's riparian land. The usual holding on this question is that the city is in the entirety a riparian owner.

A more difficult question arises when a part of riparian land, a part that does not border the stream, is sold. The question raised is whether this part retains its former character as riparian land. On this

question, there is a conflict of authority among the various states. According to one view, the right to use water in a stream is one which is derived entirely from possession of land abutting the stream, — so that land that does not border upon the stream is necessarily non-riparian. The other view is that riparian rights constitute an interest in (a property right in) land, and when once attached to a piece of land, can be conveyed like any other interest. The former of these views is better and is the one held by most courts.

It is well established that the size and shape of land is irrelevant insofar as deciding the question of whether or not it is riparian. Thus a small frontage abutting the stream is sufficient to make the land riparian. And the quantum of the rights of a riparian proprietor is not measured by the amount of his land bordering the stream, but rather by the entire extent of his contiguous land.

The legal nature of a riparian right is, in essence, that of an "easement appurtenant," except that it is a right that naturally inheres in riparian land and does not need to be created by grant or in the other ways in which easements can be created. It is a right that is legally annexed to the land. It cannot be granted to one who is not a riparian proprietor, since it is impossible to sever it from riparian realty. It passes along with the title to the riparian realty (it is "appurtenant" to it). It is in the nature of an easement since it is a right against the land of another — a right to prevent other riparian proprietors from doing certain things with their realty, such as, diverting excessive amounts of water from the stream or polluting the stream. Non-riparian proprietors cannot have riparian rights. For example, the fact that you are permitted by a riparian owner to use water from the stream does not give you any riparian rights. All you can get is a contractual right (not a real property right), which is good only against the party with whom you have con-



Return line corrosion resulting from carbonic acid

ALL pHOULED UP

pH—a symbol denoting the negative logarithm of the concentration of the hydrogen ion in gram atoms per liter. This scale permits the expression of both acidity and alkalinity in units which can be measured by means of a hydrogen electrode.

That's what chemists say about it. Some of the things that power plant engineers say about it are best left unquoted.

A low pH value in condensate

can cause a power plant engineer a lot of trouble. When the pH value of water goes below 6.9, it's becoming acid—and when it's acid, it's highly corrosive. Then it begins to eat away at the internal surfaces of pipes and return lines.

Corrosion caused by low pH is most effectively prevented by the application of Dearborn's FILMEEN*. By forming a non-wettable, monomolecular coating on all metal surfaces with which treated steam or condensate

come in contact, FILMEEN provides a protective, corrosion-inhibiting barrier between water and metal. By preventing the carbonic acid from touching the metal surfaces, FILMEEN thus keeps the lines corrosion-free.

When you find rusty condensate coming back to your boilers, it's time to see your Dearborn representative. He'll show you how FILMEEN will reduce excessive maintenance, avoid shutdowns and protect valuable equipment in your power plant.

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Servicised Clear Curing Compounds are available in both Wax Resin and Resin Base Types. Only pure synthetic resins are used with carefully controlled proportions of oils and waxes, etc., in a petroleum solvent to insure a clear, impermeable membrane. Both types can be supplied with a fugitive dye which materially assists in securing proper coverage, and which disappears after application.

WAX-RESIN BASE. A general purpose compound, usually used on mass concrete, pavements. Has excellent water retention properties, allowing slow curing of the concrete which eliminates checking. Dries rapidly and forms a film of uniform texture.

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tracted for the use of the water.

Originally, the "natural rights" doctrine prevailed in riparian law. According to this doctrine, each riparian owner is entitled to have the stream continue to flow through or by his premises in its natural condition of purity, and undiminished in quantity. Under this doctrine, any "perceptible" diminution in quantity or any "perceptible" contamination is a violation of the rights of all riparian owners. This doctrine does not prevent an upper riparian owner from taking water from the stream, provided he does not permanently remove such an amount as to decrease "perceptibly" the quantity of water flowing downstream, and providing he injects no "perceptible" amount of contaminants into the stream. As a practical matter, however, this doctrine is very harsh, particularly where industry or other large users of water are involved, since it gives virtually all rights to the lowest riparian owner at the expense of all upper owners. A violation of this right is, in legal effect, a trespass, and will support a legal action (for nominal damages) even though there has been no actual damage.

The harshness of this doctrine has been mitigated in most states—the newer "reasonable user" doctrine now supplanting the "natural rights" doctrine. According to the "reasonable user" doctrine, any riparian owner is entitled to make such use of the water as is reasonable in view of the needs of lower riparian owners. It is apparent that this is an extremely flexible doctrine, and one that will usually give very equitable results. The difficulty with this doctrine, however, is in its uncertainty. The uncertainty arises partly because of the difficulty of knowing what is "reasonable" in any given set of circumstances, and also because what is reasonable at one time may become unreasonable at a later time. The difficulty in defining the word "reasonable" is essentially the same as that encountered in the law of nuisance.

As a general rule, it is no excuse or justification to a defendant that others are also contaminating

the stream, or that the stream was not entirely pure when it reached defendant's property. Nor is it a defense that the pollution was the natural and necessary result of the particular mining or industrial operation, nor that the operations were conducted without negligence and in accordance with the general custom and practice in the vicinity or in the particular industry. The existence or non-existence of negligence is irrelevant, so long as the injury has occurred.

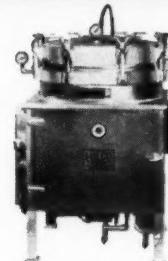
Equitable defenses, such as laches, or "clean hands," are not applicable in determining the existence of an interference with riparian rights, since the action is based on law, and not equity. Thus, it is no excuse that the complaining party did not object to opening of a mine or the building of a plant. Nor is there any public policy in favor of industrial development that would justify for the sake of a factory or mine the destruction of the rights of riparian owners. Thus, there is no balancing of "relative hardships" in determining whether a violation of riparian rights exists, — although there may be in some jurisdictions if what is sought is an injunction instead of damages.

The right to pollute waters can be purchased from a riparian owner, but it is binding only on him and on his land. It is a covenant that affixes to the land of the lower riparian owner, and it cannot be separated from this property. However, this right extends only to the land of the riparian owner who has consented to permit pollution of the stream; it does not extend to other riparian owners who have not made similar agreements. The fact that some riparian owners have made such agreements does not prevent another riparian owner from insisting on his right to an uncontaminated stream. If the pollution is a menace to health, or a public nuisance, the agreement is void as against public policy.

The right to pollute a stream can also be obtained by prescription, as well as by purchase. This will occur if, but only if, each of the following conditions have been met: the pollution must have been a violation of the rights of

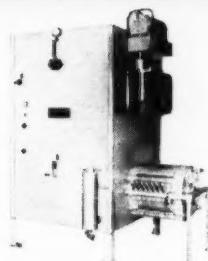
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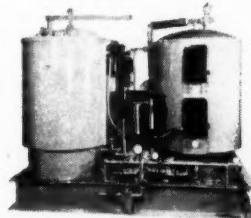
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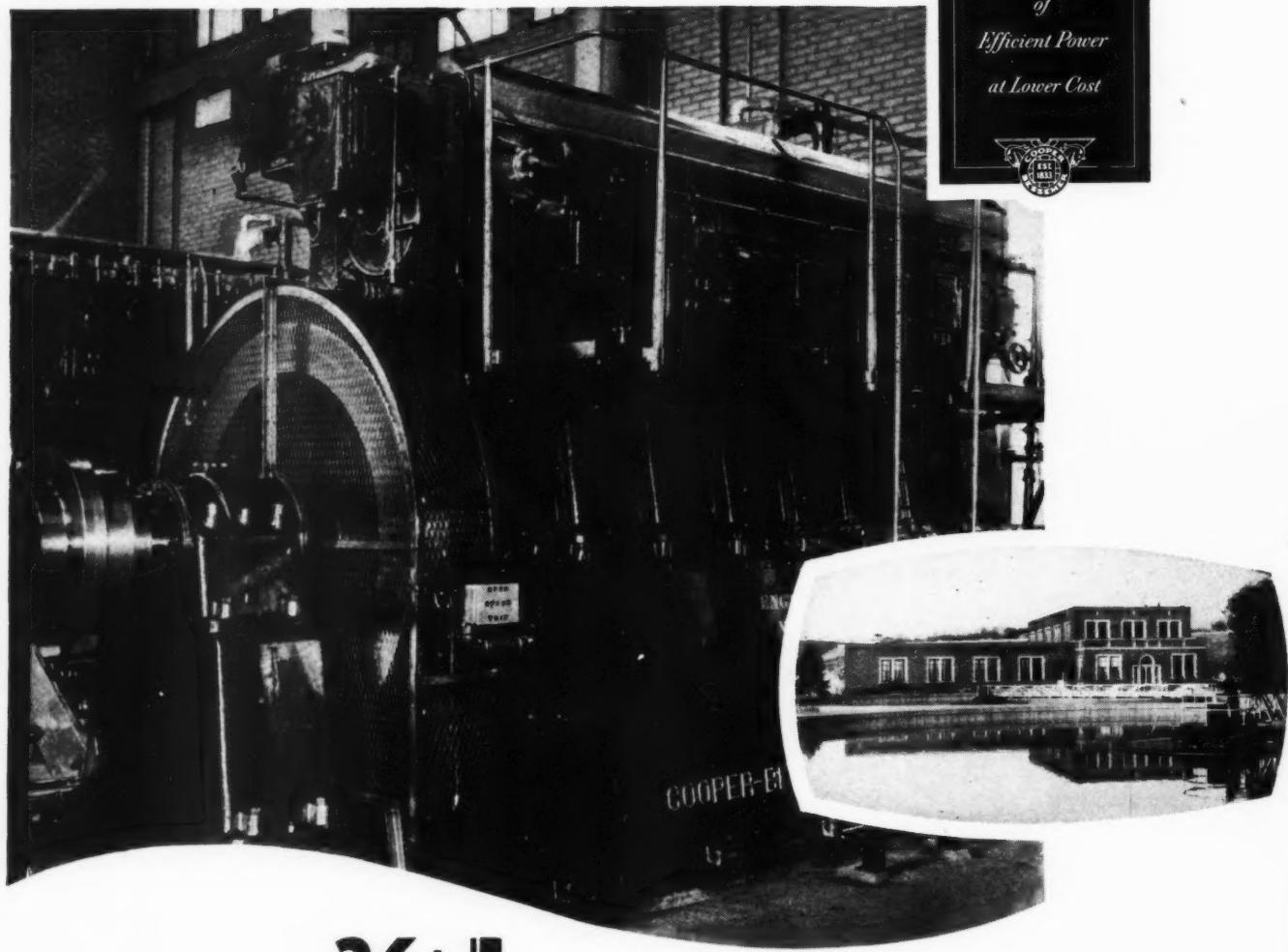
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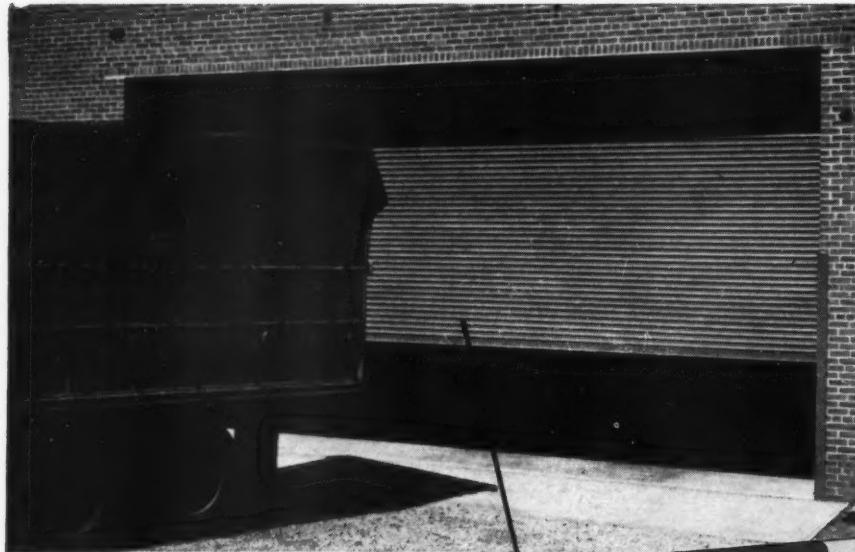
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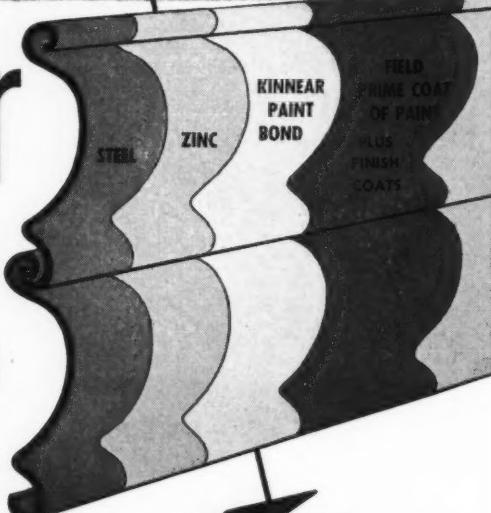
Then Kinnear's Paint Bond, a special phosphate solution is applied to make sure paint applied later will *cover thoroughly, adhere immediately, and stay on longer*.

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the lower riparian owner, it must have been adverse (i.e., without the consent of the lower owner), it must have been under a claim of right on the part of the upper owner (i.e., not secret), and it must have been uninterrupted for the full period of the statute of limitations.

The statute of limitations begins to run at the time the pollution becomes injurious to the plaintiff, in states following the reasonable user doctrine. In those states following the natural rights doctrine, the statute of limitations begins to run as soon as the pollution begins, even if it has not yet become actually injurious to the plaintiff in a pecuniary sense. This is so because his right to an action begins when the pollution begins. A prescriptive right will, however, not arise if the pollution constitutes a public nuisance. In a few states, the right to pollute can never be acquired by prescription. It is not recognized. ▲ ▲

Europe This Spring?

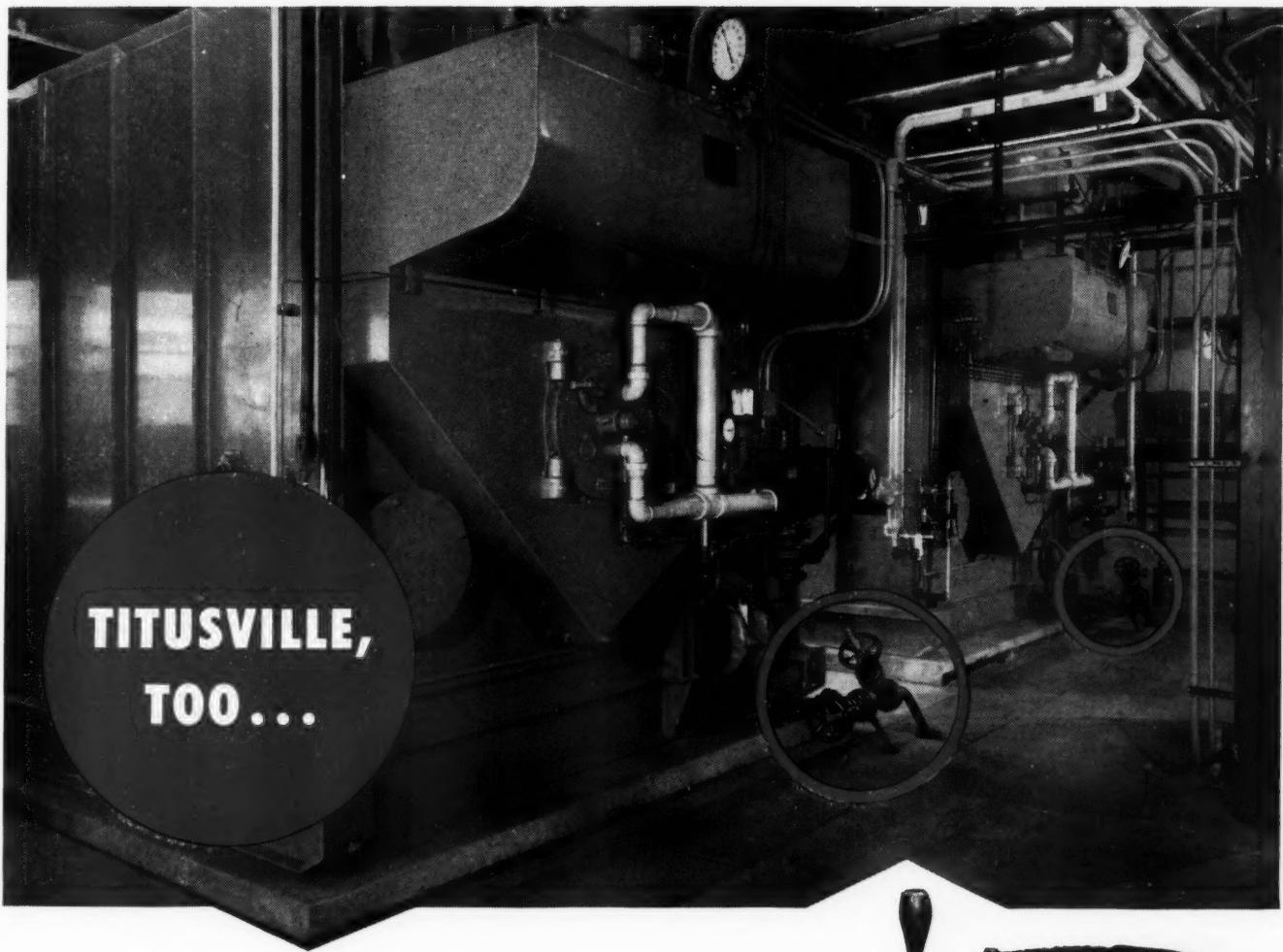


Are you spending sleepless nights and frustrated days because all of your friends keep mentioning "the last time I saw Paris," or "Oh, to be in England."

You, too, can be a sophisticated world traveler. Join the group of distinguished consulting engineers going to England, Holland, Germany, Switzerland, and France in April. Meet the outstanding consultants of Europe! Learn of important technical developments! Become an authority on "Paris in the Spring!" Take your wife to the Follies!

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Take a look at the blow-off valves on this new Titusville Iron Works WTP package boiler—they're Yarway Seatless.

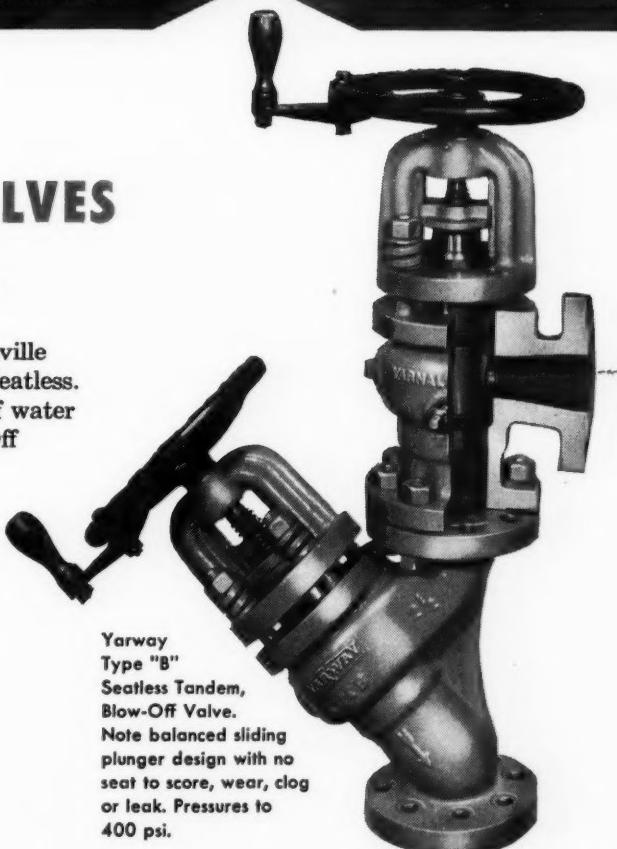
Titusville, along with most other manufacturers of water tube package boilers selects Yarway Seatless Blow-Off Valves to make good package boilers better.

Yarways seal drop-tight—have no seat to score, wear, clog or leak—combine good design with latest metallurgical improvements.

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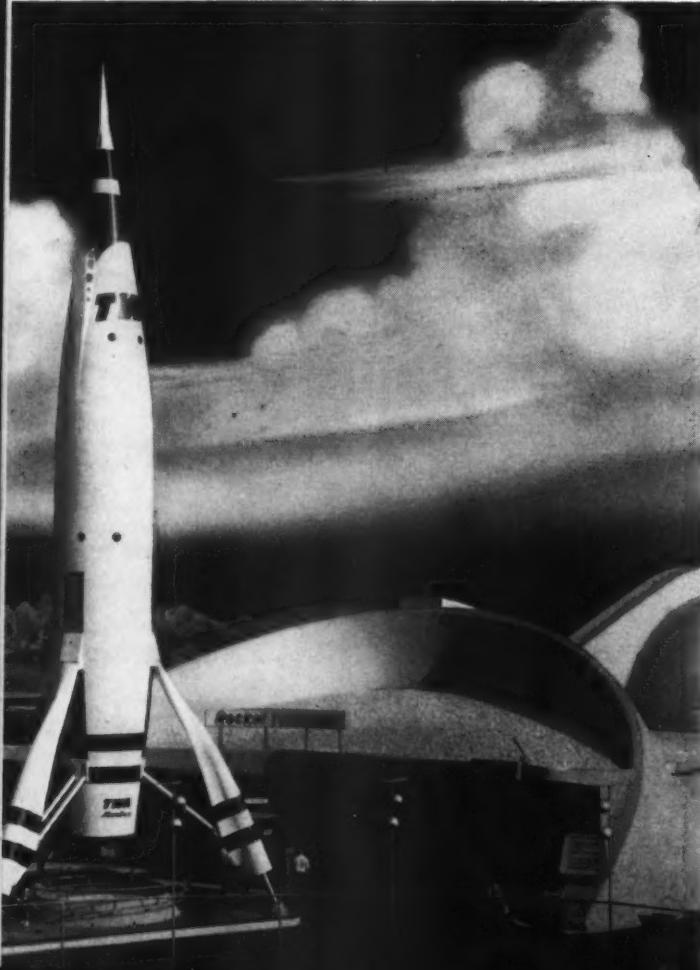
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J. S. HAMEL

J. S. Hamel is a graduate of the University of Michigan and holder of a Centennial Citation from that institution. His professional background includes seven years with Robert Moses, noted civic planner, developing recreational facilities, beaches, parks, and parkways on Long Island, plus nearly 20 years of private practice—interrupted only during World War II. Then as a Commander in the Civil Engineering Corps of the U.S. Navy, he saw overseas service in Africa and in the Middle East as well as duty in the United States.

From 1936 to 1947, Mr. Hamel operated a consulting engineering firm in New York City. He engaged in various extensive projects—principally developing beaches and allied facilities along the Atlantic Coast from Providence, R. I. to Delaware—and, in 1937, was consultant to the New York World's Fair in connection with layout of illumination, electrical, and various other facilities. In 1947, Mr. Hamel moved to the West Coast, establishing his practice as consulting engineer in Burbank, California. He and his firm since have engaged in mechanical and electrical engineering work for industrial projects, public works, and schools throughout Southern California, and in February 1954, were appointed consulting engineer for the \$17-million Disneyland project.

A member of the American Society of Civil Engineers, American Society of Electrical Engineers, American Society of Heating and Air-Conditioning Engineers, and the Illuminating Engineering Society, Mr. Hamel holds a number of patents in connection with the development of certain lighting equipment and illumination systems.

CONSULTING ENGINEER.



AERIAL PHOTOGRAPH OF COMPLETED DISNEYLAND SHOWING RELATIVE LOCATIONS OF THE VARIOUS FACILITIES.

FOR OVER TWENTY YEARS, Walt Disney envi-

Cp exclusive
sioned a "Magic Kingdom" encompassing a lavish new kind of entertainment designed for family participation. With the opening of "Disneyland," on July 18, 1955, this dream came true. To the young it is a land of the enchanting past and the boundless future; to the older generation it is a place to relive fond memories of days gone by and to renew the challenge of the world of tomorrow.

Background

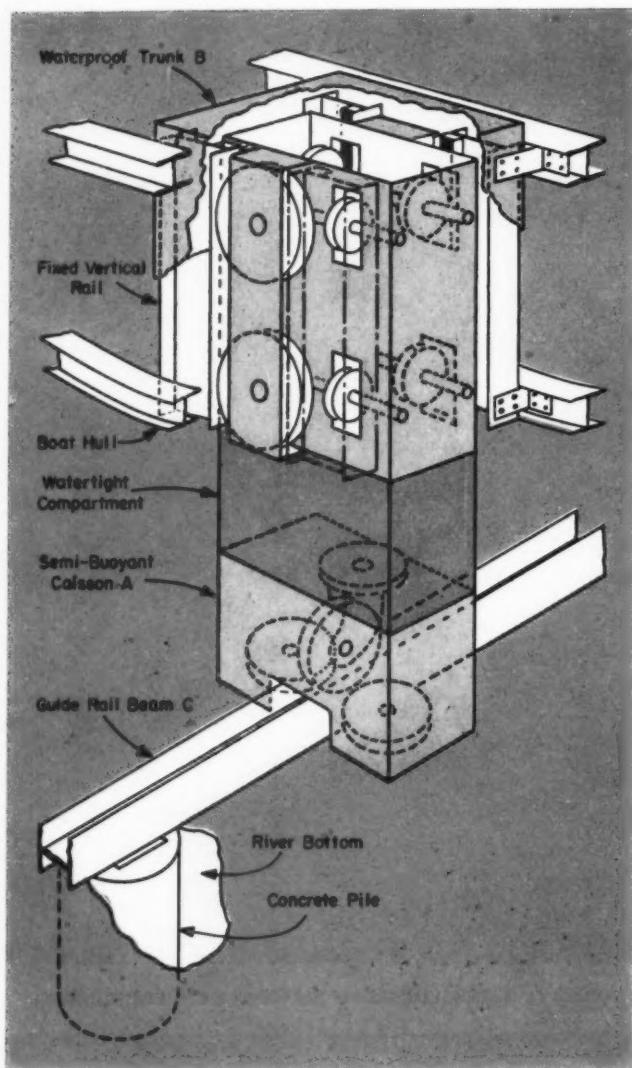
In designing Disneyland nothing was left to chance. As soon as Disney had put his ideas into sketches, the wheels of research began to turn, and the need for technical data began to pyramid. Since a location within the vast metropolitan area of Los Angeles was of prime importance, experts were retained to assist in the selection of the site. Accessibility, topography, environment, and utilities all were investigated before choosing a section of land adjacent to the city of Anaheim. This site is approximately 23 miles southeast of the center of the city of Los Angeles and immediately adjacent to the main Santa Ana freeway route.

By the time the property had been purchased and ground broken, scouting teams were traveling over the United States and Canada to procure authentic equipment. Three cities in the East supplied gas lamps to line Main Street. Some of the cresting and railing in Frontierland came from Nashville and Memphis, Tennessee. Other antique equipment came from New Orleans and from numerous other cities and communities across the nation.

Even the landscaping posed problems as areas representing a range of climate conditions from the northern border of our country to the tropics were to be created within a few hundred feet of each other. Subtropical plantings were procured from various U. S. locations. From Australia and the Pacific Islands came supplies of lush tropical effects for the Adventureland boat rides area.

Design and Planning Organization

Fundamentally, all ideas for the project stemmed from Walt Disney and his unique production organization — Walt Disney Productions. However, since W.D.P. primarily is engaged in making pictures, a new design and planning organization known as WED Enterprises was created, with Disney at the



DRAWING SHOWS THE CONSTRUCTION DETAILS OF THE GUIDE MECHANISMS DEVELOPED FOR THE "MARK TWAIN."

head and staffed with the best design, planning, and artistic talent available. It was the task of WED Enterprises to translate Disney's concepts into working drawings for construction.

Disney selected an art director who is a veteran of many years experience in the motion picture industry to head all design work. Five separate design groups were set up under his supervision, each having its own art director and staff of artists and designers. These five art directors were charged individually with the responsibility of preparing construction drawings, coordinating the requirements of concessionaires and exhibitors, and planning public facilities and utilities for their assigned area.

¶ Main Street, covering the Railroad Station and all of the construction up to and including the circular plaza located in the center of the park.

¶ Adventureland, embracing the Adventureland Jungle River boat trip, the Arboretum, and Bazaar.

¶ Frontierland, including the river, a stern-wheeler steamboat—the *Mark Twain*, buildings, and "rides."

¶ Fantasyland, encompassing the castle with moat and drawbridge, restaurants, and a variety of rides. ¶ Tomorrowland, enveloping exhibit buildings and rides, including a simulated rocket trip to the moon.

A Master Plan was developed by the art director under Disney's personal direction. This task involved coordinating of contouring, railroad planning, and general site development for roads, parking, and walks with other basic facilities. Finally to supply the technical assistance needed in many phases of the project, the firm of William E. Wheeler was engaged for structural design, and we were retained for all other engineering design, with A. A. Dorman in charge of civil engineering for our organization.

In addition to the work of these technical groups, Stanford Research Institute made extensive traffic studies based on the anticipated daily population. Mr. A. K. Morgan, of the Palisades Interstate Park Commission, veteran of many years under Robert Moses, was called in to assist in laying out the required parking facilities in the surrounding area.

Project Schedules

Although the working drawings were not started until February 1954, the opening date was set for July 1955—a period of less than 18 months to complete a \$17-million construction project from the beginning of the design phase. Rigid and seemingly impossible schedules were set up for the production of engineering drawings and for the site development. Work also began on a television show, scheduled for international release coincidentally with the projected grand opening of Disneyland.

Despite the tight time schedule, every effort was made to work out the details of the many novel designs accurately. Models of every unusual device and structure were turned out in Disney's studio model shop before final approval of each design. Since little that went to make up Disneyland was ordinary, this called for a large, fast moving, talented group, who came from Walt Disney Productions and the studio shops. Sketches were developed, then $\frac{1}{4}$ -scale models, and finally full-sized working models.

Testing Facilities

A special building was constructed on the Burbank studio lot for testing and studying the many rides and amusement devices. The Peter Pan Ride, consisting of an electrically powered monorail car in the form of a sailboat suspended from a powered "mule" on an overhead track, was built and tested in a section of this building. Here also tests were made on the many trick systems of illumination, using ultraviolet light and luminous paints for the unusual and beautiful scenes created by Disney artists for the three Dark Rides in Fantasyland.

Models of water effects for fountains, railroad coaches for the train, and plastic animals with hydroelectric operating mechanisms were built and tested in the studio shops. A large tank in one of the studio

sound stages, originally built to film parts of "20,000 Leagues Under the Sea," served as an ideal test basin for the various "guided boat" rides and for the crocodiles and hippopotami now found half submerged in the jungle rivers of Disneyland.

The "Mark Twain"

From an engineering viewpoint, however, perhaps the most extraordinary tasks were those of designing and building the principal boat rides. In conceiving the *Mark Twain*, Disney's idea was to give the public a chance to ride on an authentic scale reproduction of a steamboat of the type that plied the Ohio and Mississippi rivers in the late '80s. The setting was to be a meandering river simulating a typical scene anywhere from Pittsburgh to New Orleans.

Since the river was destined to be the largest body of water in the park — approximately 9,000,000 gallons capacity — it figured prominently in the drainage studies. The normal water level of the river was set as the low point for storm water runoff, and all other elevations then were calculated so that all drainage from the entire park area flows into the river. If there is any rise in the river water level, the excess flows by gravity to an adjacent off-site gravity storm water drainage system.

During fair weather, the river water is recirculated by a 4000-gpm vertical lift pump, located at the north end of the park. This pump operates 24 hours a day to provide maximum aeration and circulation and to create a flowing stream, meandering through the park. It is shut off during a rain when the stream bed acts as a storm water drain.

Although ample water was available from two, 16-in., 1000-gpm wells on the property, new prob-

lems developed when constructing the river. Coarse, clean sand at the site soaked up water like a sponge, and a limited budget and lack of time for study forced an early decision for a means of waterproofing. Concrete was ruled out as too costly and too artificial in appearance. Tests with Bentonite also were unsatisfactory. Finally, a 12-in. layer of compacted clay proved to be the answer to forming a 100-percent watertight bottom for the river. Now lush landscaping of trees, shrubs, grass, and cattails lines the shore and makes the river look natural.

Extensive research also was required to authentically build and outfit the \$200,000 paddle-wheeling riverboat, the *Mark Twain*. Being the first of its kind to be built in the United States in over 50 years, considerable time went into the study of riverboat design and operating requirements. Because the *Mark Twain*, like many other installations at Disneyland, is on $\frac{5}{8}$ scale, its horizontal, noncondensing steam engines had to be specially built. Furthermore, since the river, also on $\frac{5}{8}$ scale, is tortuous, the boat had to be guided by some positive means.

Design of the Guide Mechanism

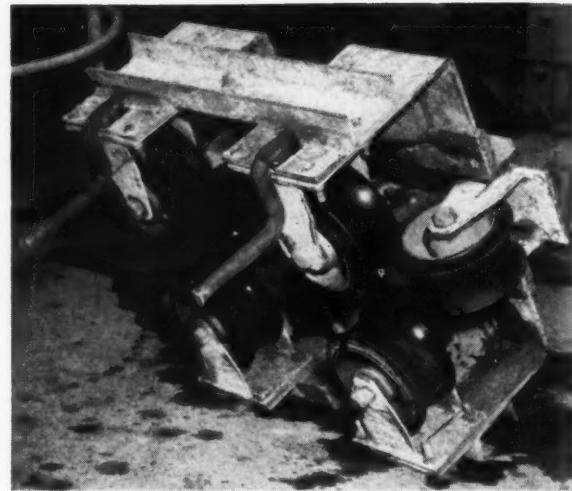
While the design of the vessel itself was progressing, we were assigned the task of developing a means of guiding this 125-ton riverboat on a predetermined course. Calculations of maximum horizontal thrust of the boat were made, taking into account wind effect and centrifugal force based on the boat's travel along a 125-ft radius at a speed of approximately four knots. Then many possible solutions



ABOVE. VIEW OF RIVERBOAT DOCK DURING CONSTRUCTION, SHOWING STEEL GUIDE RAIL FOR "MARK TWAIN."



RIGHT. IDENTICAL VIEW SHOWING COMPLETED DOCK WITH "MARK TWAIN" SET FOR TRIP DOWN THE RIVER.



ABOVE. VIEW SHOWING A GUIDE MECHANISM FOR THE JUNGLE RIVER BOATS IN ADVENTURELAND.

LEFT. VIEW OF JUNGLE RIVER WITH GUIDE RAIL IN PLACE, PRIOR TO POURING OF GUNITE LINING.

were considered from a continuous underwater cable much like those used to pull the cable cars in San Francisco to hydraulic jets operating under water that would steer the boat by reaction.

After extensive study and tests, we designed the guide mechanism assembly shown in the accompanying sketch, and two of these units were built, one for location forward and the other aft. Basically, each unit has a semi-buoyant caisson A, approximately 6-ft long by 2-ft wide by 1-ft deep, that is mounted vertically in a steel waterproof trunk B built into the hull of the boat. The guide mechanism's fiber and neoprene wheels and water lubricated bearings are built into caisson A, and the vertical guide rails are an integral part of waterproof trunk B in the boat hull. A watertight compartment makes caisson A semi-buoyant and facilitates the vertical movement attendant to the displacement of the boat and the water level of the river.

Main Guide Rail

Two large horizontal guide wheels at the bottom of each caisson ride against the 6-in. wide flanges of a 25-lb, H-section steel beam C placed with the flanges vertical. A flexible caster, mounted vertically, rides on the web of beam C, with the vertical reaction of the semi-buoyant caisson assuring constant contact between the drive mechanism and the guide rail without causing excessive drag.

In view of its size and the problems encountered involving both time and cost, it was impractical to actually build and test this mechanism before construction of the boat was begun. However, all of our engineering studies indicated the device would perform satisfactorily, so the continuous H-section rolled steel guide rail C was laid out to the exact curvature and alignment desired. Expansion joints

were provided at three points, solely for the purpose of preventing any buckling from solar heating during the period from the completion of the guide rail to the filling of the river with water.

Guide Rail Supports

Poured-in-place concrete piles, approximately one foot in diameter and 12-ft deep with adequate reinforcing for the calculated maximum thrust conditions, were used to support the guide rail. Base plates with anchors were set in the tops of these



BACKSTAGE VIEW OF GIRAFFE'S OPERATING MECHANISM.

piles, and the guide rail sections then were welded to each of the base plates. Piles were placed at 12 feet on centers on curves and approximately 24 feet on centers along tangents.

Both the hull of the boat and the guide mechanisms were constructed by Todd Shipyards, at San Pedro, California, and then hauled to Disneyland — a distance of approximately 25 miles — on a flatbed truck trailer. This in itself was quite a task since the boat has a hull about 105 feet in length with a 27 ft 6 in. beam displacing approximately 125 tons. The superstructure of the boat was designed and built at Walt Disney's studio, in Burbank. After the hull was lowered into a dry dock at the site, the superstructure was moved down in sections and erected on the deck of the boat.

Filling of the river started about the first week in June of 1955. The water level rose steadily, and after some leaks, which developed at the bulkheading, were stopped, the river finally was raised to its nominal depth of five feet. This level had been selected after considerable study as being adequate for the *Mark Twain*'s draft of approximately 27 inches and also to allow for about a 6-in. rise during extremely heavy rainfall. Then the boat was floated out into position at the main dock, and the guide mechanisms were lowered in the trunks. Divers were employed to see that the mechanisms set properly on the rail.

With both mechanisms in place the time had arrived for the trial run. The new, horizontal, non-condensing steam engines were put into operation, and the large paddle wheel began to turn. As it churned the water the boat inched ahead along the guide rail. There was probably no greater thrill to

those responsible for this device than that which came when the boat started around the first bend, about 100 feet after leaving the dock. The boat rode into the bend without a sound; slowly the bow swung to starboard without so much as a vibration. Except to the trained ear and touch of the engineer there was nothing about the *Mark Twain*'s graceful turning to indicate that she was not being piloted around the bend by the conventional rudder. We steamed down the river, and in approximately 30 minutes completed the maiden voyage over the 2760-ft waterway course. Subsequent shakedown cruises proved that the guide mechanism would work under all operating conditions, and the boat is now on a regular 20-minute, round-trip schedule.

The Jungle River Ride

Equally effective results also were obtained with the guide mechanisms we designed for the Jungle River Ride, in Adventureland. On this trip, gasoline powered launches, which are authentic reproductions of the jungle river explorer boats of Africa and South America, each carry thirty passengers down 1/3 mile of jungle river and through swamps infested with "wild" animals. Each boat is approximately 30 feet in length, with an 11 ft 6 in. beam and a draft of less than one foot. The hulls are of Fiberglas and other lightweight materials, powered by 20-hp gasoline engines driving 10-in. propellers.

Since this jungle river ride is in a closely confined area —approximately five acres in size with a boat run about 1700-ft long — developing suitable guide mechanisms presented numerous problems. At some places the river is so narrow the clearance between



JUNGLE RIVER BOAT PASSING UNDER WATERFALL. CLIFFS ARE SCULPTURED GUNITE AND COLORED CEMENT PLASTER.

the boat and boulders built into the river bottom is less than three inches. In addition, the guides had to be flexible enough to allow for constant pitching and bobbing of the boat as crowds shift from one side to the other or listing of the boat on sharp bends. Obviously, the use of normal rudders for steering was out of the question.

After considerable study, we designed a second guide system to meet these operating conditions. This system has a guide rail of 2½-in. diameter, standard weight, steel pipe that is supported on ¾-in. diameter, solid steel bars anchored to concrete footings below the surface of the river bottom. It might be noted here that the river bottom is a 2½ to 3-in. membrane of gunite. This assures watertightness and also provides adequate support for the various operating devices and animals installed in the river. The gunite was not brought straight to the surface of the water at the shore line, but instead was turned into the river bank for a short distance and then carried up above the water level to provide a continuous waterproof liner. Tropical plants and shrubbery were planted right down to the water so that there is no evidence of the concrete liner to detract from the natural appearance of this river, yet the solid bottom facilities maintenance of the operating devices.

Guide Mechanism Details

Details of the mechanism that guides the jungle river boat on the 2½-in. pipe are shown in the accompanying photograph. Two such guides are used, one located forward and one located in the aft portion of the boat. Each of these guide mechanisms consists of a galvanized steel truck with six neoprene wheels grooved to fit the sides of the pipe. Four of the wheels roll in a horizontal plane, two on each side of the guide rail. The other two wheels sit in a vertical position and roll along the top of the pipe to support the mechanism and to maintain the contact of the horizontal guide wheels. Engagement with the boat is through a hinged tubular steel stem, attached to the top of the mechanism. It is free to move in a tubular steel sleeve anchored securely to the hull. This construction provides an action that is similar to a free floating piston in a cylinder.

With this arrangement, the mechanisms ride on the rail irrespective of the roll of the boat, yet they maintain the required alignment throughout the boat's course. It was important that the boat be unrestricted in its listing, pitching, and bobbing in order to be realistic. Neoprene wheels were used throughout, so that the action of this guide mechanism rolling on the steel pipe would be perfectly silent. Unsuspecting passengers who ride this boat believe that the pilot actually is guiding the boat down the river through all of its many gyrations.

Since the boats are gasoline powered, the necessity of being able to get them off the rail for servicing presented another problem. This was solved by

reducing the rail diameter along the dock to one inch, so that the guide mechanism could be lifted from the rail and latched in the up position. Then the boat can be towed away with the mechanism retracted. When a boat is brought back into position it is set between guides, and the mechanism is lowered onto the rail. As the boat leaves the dock, the rail increases gradually to the 2½-in. diameter. From this point on the boat is securely locked on its guiding rail for the remainder of its journey.

Other Trip Features

It also may be of interest to note another function of the guide mechanism. As each boat progresses down the river, a series of small trip levers located adjacent to the guide rail are actuated by its trip bars. This tripping action opens small valves which, in turn, energize electrical contacts located on the shore above water. This puts various animals and devices through their paces, timed with the passing of the boat.

Hippopotami rise in the water, wiggle their ears, roll their eyes, and open their mouths. A giraffe munches on some palm branches. Elephants raise their trunks and trumpet loudly. In passing through villages, natives along the shore bob up from behind logs and peer from around trees, menacing the passengers in the boats with spears, blood-curdling screams, and the beating of tom-toms. Each time the cycle is completed, the trip mechanisms are reset automatically for the next boat.

Other features of the trip include an artificial waterfall, simulating Victoria Falls, surrounded by cliffs of sculptured gunite and colored cement plaster relief. The falls are only 16-ft high, but 3000 gpm of water pour over its brink. On both the outgoing and return trips, the boats pass under the falls, narrowly missing the cascade each time. The effect of rapids also was created by means of high pressure water piping below the river bottom with injectors to create a boiling action and a rushing current. Yet the guide rail permits realistic boat movement without allowing any deviation from the set course.

At night the Adventureland boat ride becomes even more effective. Lights concealed in the shrubbery and beneath the trees add to the mystery of the animals and foliage. In the semidarkness the animals seem even more menacing than during the day. Approximately 10,000 to 12,000 people enjoy this ride during a single day at Disneyland. In the summer months there is a waiting line for the jungle river ride until closing time at 10:00 P. M.

We, as engineers, had a field day contributing toward making Disneyland truly the "Magic Kingdom" of happiness, knowledge, and safety that Walt Disney believed it could be. Here the familiar, the novel, the thrilling, and the beautiful have been fused to create one of the most delightful entertainment parks in the world.

MODERN STOKER-FIRED BOILERS

Despite the relatively wide extent to which oil — and gas — have come into use for firing industrial boilers, the fact remains that coal continues to be the most economical fuel available in many areas.

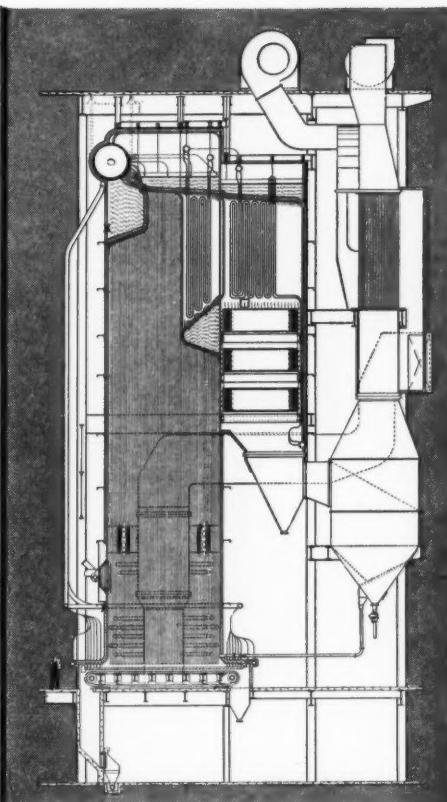
Moreover many potential coal users are unaware of the tremendous improvements that have been made in recent years in the design and general effectiveness of mechanical stokers. Here at Combustion virtually the entire stoker line has had extensive design changes, all directed at improved performance. But overall performance is tied in inescapably with boiler performance. At Combustion you have the important advantage of dealing with a leading boiler manufacturer that also offers the most complete line of stokers available anywhere. You are assured, therefore, of a completely coordinated design comprising stoker, boiler, furnace and — if desired — heat recovery equipment and/or auxiliaries, all engineered specifically for your particular requirements.

Displayed below are three — of the many — C-E stoker-fired boiler designs which, collectively, are suitable for any coal-firing conditions.

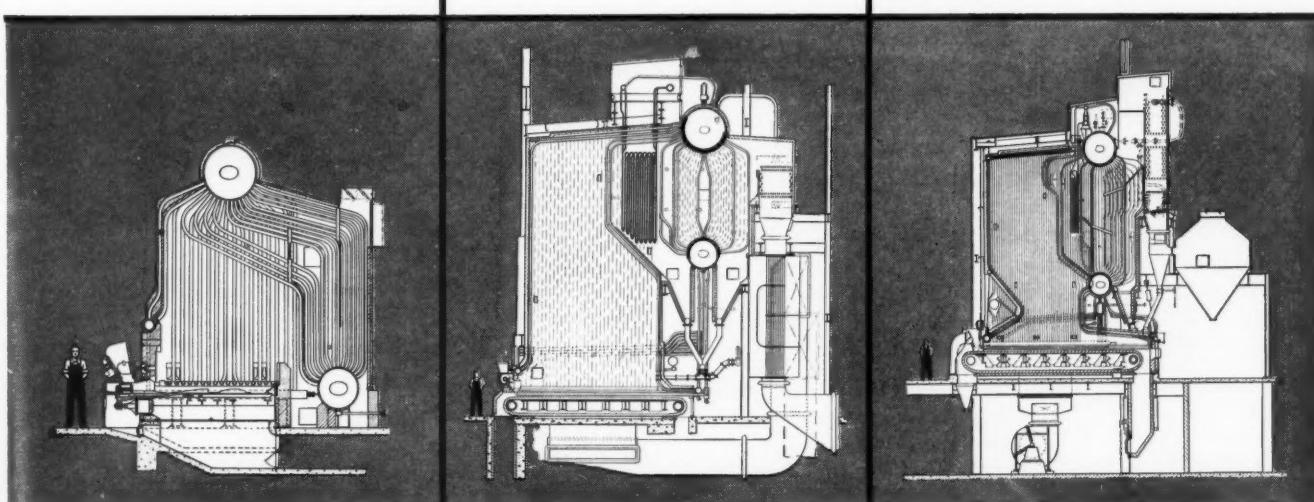
At the right is illustrated the latest — and largest — example of the C-E Bark-burning Unit, a design pioneered by Combustion and now widely used for burning bark, hogged-wood and other waste wood fuels.

So — when you are in the market for coal or other solid-fuel-burning units it will certainly be to your advantage to find out what Combustion Engineering has to offer. Our engineers will be glad to discuss your needs with you or your consultants.

B-892A



C-E BARK-BURNING UNIT for a paper company. This is a very large unit; capacity — 450,000 lb steam per hr, operating pressure — 1335 psig; total steam temperature — 958 F. It is designed to burn bark, natural gas, oil or any combination thereof. These units are in service for capacities as low as 20,000 lb of steam per hr.



THIS C-E VERTICAL-UNIT BOILER, TYPE VU-10 fired by a C-E Underfeed Stoker, Type E is for a dairy. Capacity is 30,000 lb steam per hr at 150 psig. VU-10 Boilers are available for capacities from 10,000 to 60,000 lb of steam per hr. They are often equipped with C-E Spreader Stokers, dump grate type.

ONE OF TWO DUPLICATE UNITS for a chemical company comprising C-E Vertical-Unit Boilers, Type VU-40 fired by C-E Spreader Stokers, continuous discharge type. These are baffleless boilers designed for a capacity of 150,000 lb steam per hr at 900 psig and 808 F. Coal is Eastern Bituminous.

THIS C-E UNIT is being installed for a soap company. It comprises a C-E Vertical-Unit Boiler, Type VU-50 fired by a C-E Traveling Grate Stoker. Coal used is Midwest Bituminous. This boiler is designed for a capacity of 100,000 lb steam per hr at 850 psig and 585 F. It is an outdoor type unit.

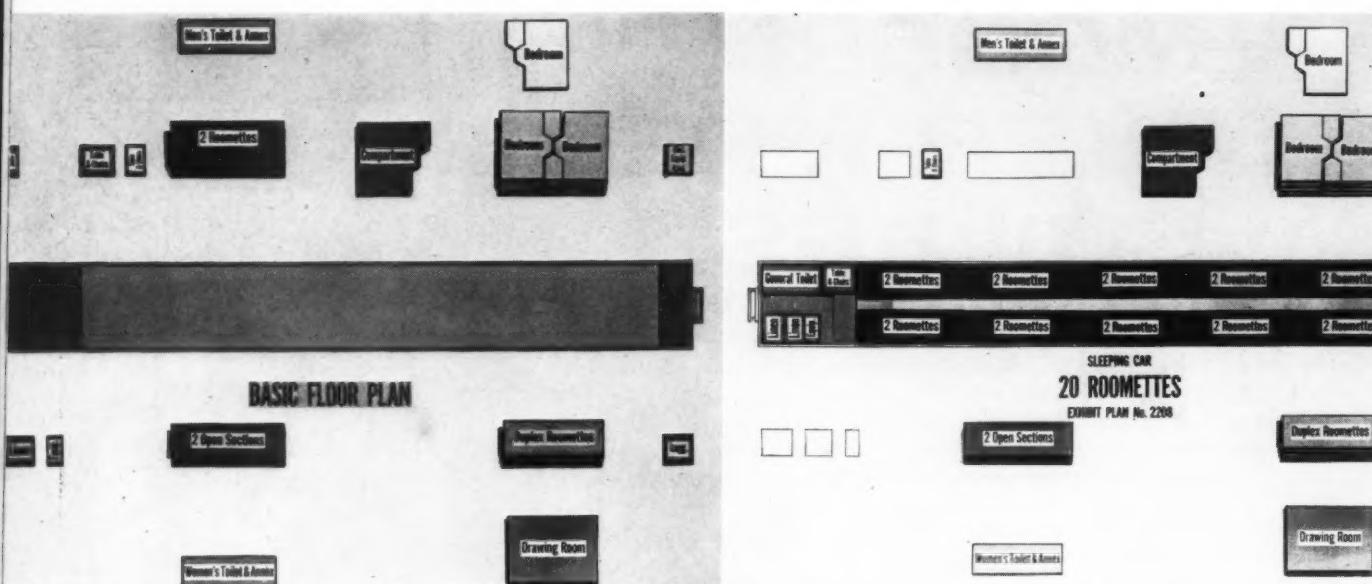
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HERE IS A BASIC MODULAR PLAN FOR A PULLMAN CAR. IT WILL ACCOMMODATE 20 ROOMETTES AS SHOWN ABOVE.

JOHN J. MAHONEY
Consulting Engineer

John J. Mahoney, currently a consulting engineer in New York City, received his degree in Chemical Engineering from the College of the City of New York, in 1940. He then went on to the University of Pennsylvania to do graduate work on an industrial fellowship. For fifteen years he has done design, construction, and operation work in chemical and process engineering, specializing in projects involving fats and oils, detergents, dyestuffs, and organic and inorganic chemicals. He has also done a number of evaluation studies for various chemical processes and plant installations. He was at one time with Foster D. Snell and later with James P. O'Donnell, both consulting engineers in New York City.

ONE OF THE DUTIES of the consulting engineer is to act as a cost diagnostician and an investment counselor to his client. In this confidential capacity he must operate much like the doctor or the lawyer. His stewardship consists of installing as much equipment as possible at the lowest practical cost and assisting the client in obtaining an optimum yield on his investment. The consultant's influence on engineering costs and equipment procurement—while not absolute and final—is strong. He spends

Economy Through M

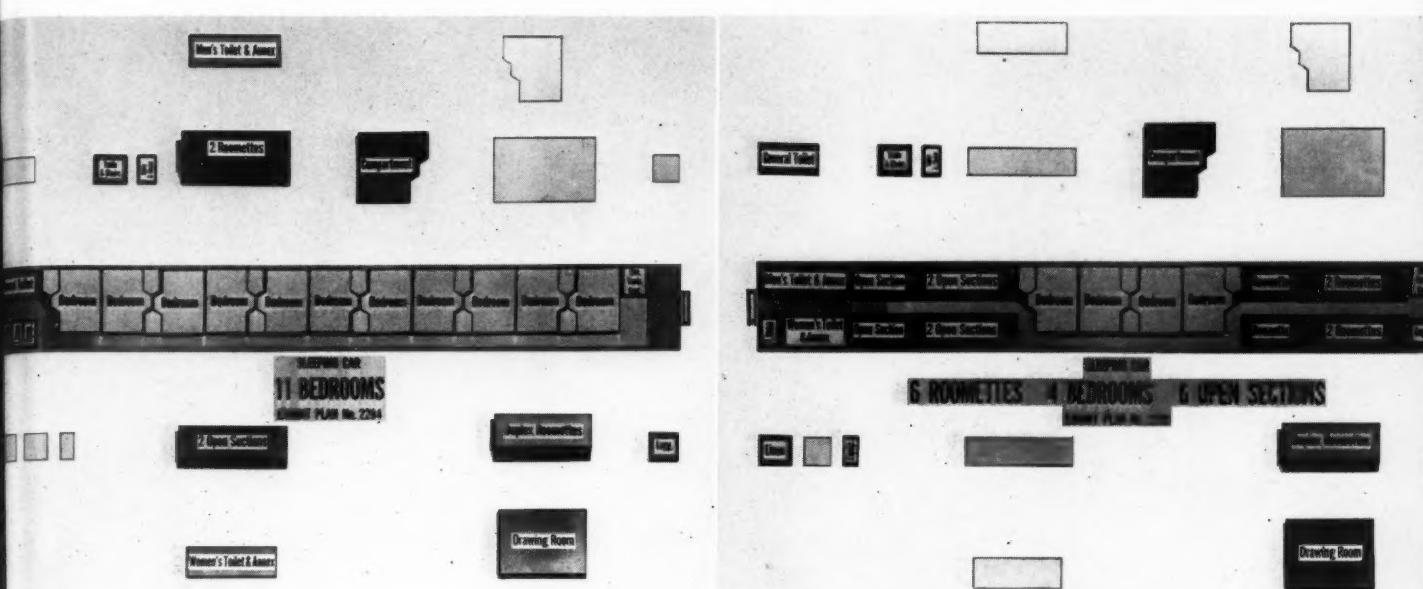
his client's money as wisely as possible and prays quietly that his client will continue in robust financial health.

Today we have a relatively stable but competitive economy, and the consulting engineer is being asked to cut costs. Indirect costs, especially, are coming in for scrutiny. These costs include drafting, engineering, and construction supervision. Methods of estimating these costs have been suggested by O'Donnell,⁽¹⁾ Lang,⁽²⁾ and others. Definitions of terms also have been covered by these authors.

As the graph shows, these costs can be surprisingly high—as much as 40 percent on a project with a total cost of \$200,000. (see page 53)

The consulting engineer who itemizes his drafting and engineering frequently is criticized because they make up such a large percentage of the cost. However, a manufacturing firm with a good system of cost control would soon find that their own internal costs for engineering and drafting are of the same magnitude. Unfortunately, the manufacturing firm does not always have a good system of accounting and may fail to perceive this important point.

Modules and standards suggest an approach to the problem of cost reduction. The air conditioning engineer, the construction expert, and the power plant



OR THE SAME FLOOR PLAN WILL TAKE 11 BEDROOMS; OR 6 ROOMETTES, 4 BEDROOMS, AND 6 OPEN SECTIONS.

Modular Design & Standardization

man have devised modules and standards. Other industries also have standardized and profited thereby.⁽¹¹⁾ Modular design and standardization are being used even in the automatic manufacture of electronic equipment.⁽¹⁴⁾ In the construction field the elimination of hand cutting and fitting at the site with the help of standards and modules has resulted in large savings. In the industrial field equipment installation, piping, and building construction provide a fertile area for similar cost reduction.

Modular design will reduce costs without impairing quality or impeding new ideas. In the construction field, a module of four inches is selected.⁽⁴⁾ The architect, engineer, and builder then work with this module in mind. In home building, for example, the various materials such as the gas range, bathtub, and refrigerator are selected with this module as a dimensional guide. Several hundred manufacturers now make items for house construction on modular design principles. Engineering, drafting, and labor costs have been reduced. In time we can expect the use of modular design in industrial equipment, piping, and plant construction.

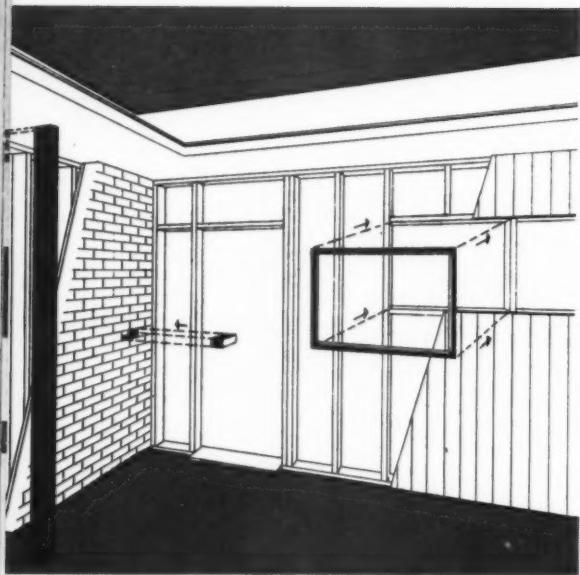
There are other modules such as the "ton of refrigeration" and the "pound of steam per hour." A module need not be a linear dimension. A module

is a "standard or unit for measuring." Competition, engineering efficiency, and modular design have provided a packaged air conditioning unit which is rather easy to buy and install. The package boiler now comes in sizes up to 35,000 pounds per hour ready for installation on the client's foundation.⁽³⁾ Electrical distribution systems also are made on a modular basis.

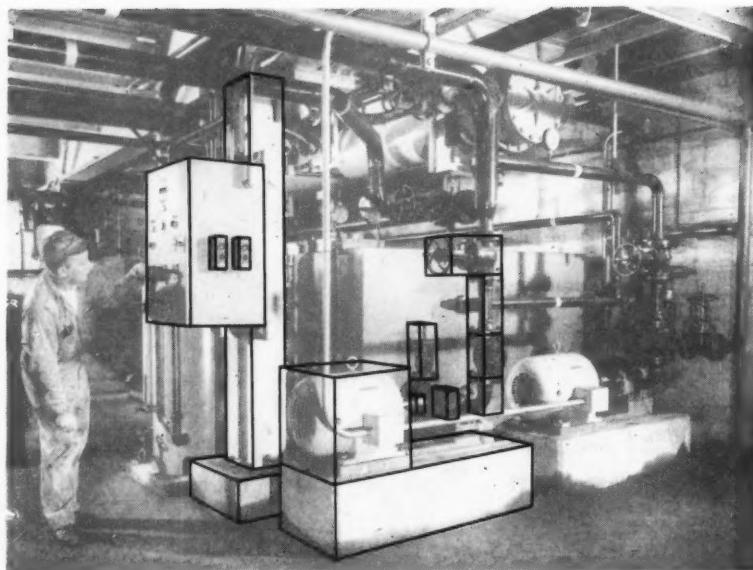
Modules and standards will free the consulting engineer of many of the petty details of his present work and enable him to apply his energy to the larger picture of construction management, operations, and investment analysis and control.

The principle of standardization and interchangeability of parts is not a new concept. Each industry as it grows tries to conserve manpower and materials. Each investor tries to obtain the best yield from his investment. As Melnitsky⁽¹¹⁾ points out, standards are no more than solutions to recurring problems, and such standards will reap profits.

The design and construction of laboratories in the United States was the subject of an article by H. S. Coleman.⁽⁸⁾ By the use of repetitive space units, often 10 feet long, 26 feet wide, and 10 feet high, plus standard services such as cold and hot water, gas, air conditioning ducts, and drains, the



MATERIALS OF CONSTRUCTION MADE OR CUT TO MODULAR SIZE TO SPEED ASSEMBLY.



ENGINEERING EQUIPMENT DESIGNED TO MODULAR MEASUREMENTS WOULD FREE ENGINEERS TO CONCENTRATE ON ORIGINAL WORK.

way was cleared for a reduction in the indirect costs.

The consulting engineer must keep this principle in mind: With a fixed budget for the erection of a laboratory building (or an industrial plant or office building) a saving in indirect costs by the use of repetitive space units is worthy of investigation.

Mechanical Equipment

As an area where the consulting engineer can point the way toward savings, the field of pumping and heat transfer suggests itself. Standards could cover pump design, materials, inspection, and test. Standardization of pumps will mean quicker repair and replacement in the field. Heat exchangers need standardization, also. These items, like pumps, could be purchased off the shelf.⁽⁷⁾ Engineering and drafting time spent on custom made pumps and heat exchangers may prove an embarrassment to the consulting engineer unable to justify the added expense to his client.

Hundreds of millions of dollars are spent annually on distillation equipment, and the variety of sizes and types of columns and internals is truly astonomic. Often a liberalization of process specifications would enable the fabricator to suggest standard components and bring about savings in engineering, drafting, and fabrication. The consulting engineer should avoid slavish submission to design data that make for one-of-a-kind construction and raise all costs on the project. Considering the overloading of such equipment in actual practice, one usually is amazed at the rigidity of the process specifications.

The consulting engineer, should, of course, point out and explain any savings to the client if standard components can be employed.

Small spray dryers measuring from 10 to 14 feet

in diameter can present unusually high engineering and drafting charges, and the consulting engineer who is new in the field is cautioned against making hasty guarantees of performance and cost. A package unit based on existing engineering calculations and drawings and built in a shop familiar with the unit will be cheaper to build and install. Clients willing to accept these modular features in design can save money. Those who insist on a unique solution to their problems must be prepared to pay the higher costs for the custom-made unit. The consulting engineer must help the client see the wisdom of one solution over another.

Drafting Innovations

Some steps that have already been taken to reduce drafting costs are as follows:

Recently the magazine *Heating, Piping, and Air Conditioning* reported the use of photographs to cut costs.⁽⁸⁾ Drafting, which had run 6 to 7 percent of the job cost, was reduced to 1 to 2 percent. The consulting engineer also will find photographs helpful in discussing a layout with the client and following the progress of work.

The increased use of models in plant construction and maintenance is making the engineer's job easier and eliminates much unnecessary drafting. Some criticism is heard because of the expense involved, but increased use of models is noted in most fields. The model is, of course, useful in training personnel and for advertising and promotional work.

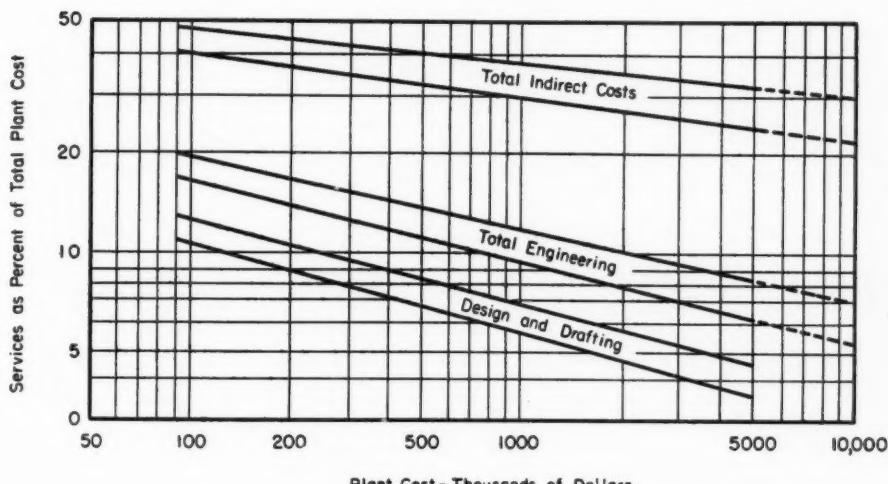
Pilkington⁽¹⁰⁾ has estimated that up to 30 percent of the drafting time on a complete plant layout can be saved by using a three dimensional drawing. Procurement and field work is improved, and the

axonometric drawing serves as a flow-sheet and operating guide for new personnel.

A drawing is nothing more than a means of communicating with the client, the vendor, and the field worker. The consulting engineer must seek better means of communication—he must be willing to try out a variety of new ideas.⁽⁹⁾

Terminology

Terms like "modular design"—and "standards" are not too widely used—or understood. Management will not be aware of new advances in the engineering field unless the consulting engineer himself understands these new concepts and relates them to dollar savings. Many cost terms are misunderstood, and many industrial managers are simply certain that

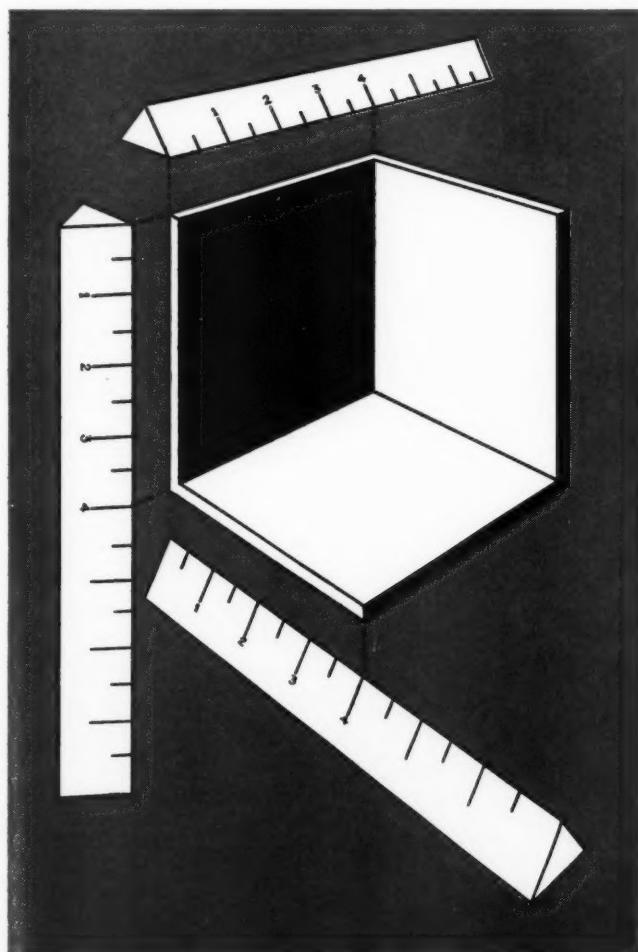


COSTS OF ENGINEERING SERVICES ON INDUSTRIAL PROJECTS. INDIRECT COSTS INCLUDE CONSTRUCTION SUPERVISION AS WELL AS OTHER COSTS.⁽¹⁵⁾

outside engineering (salary, overhead, and profit) is more expensive than the similar internal service. It is the consulting engineer's task to point out that engineering and drafting is a sizable expense whether purchased internally or externally and should be subject to a strict system of audit and accurate cost control.⁽¹⁾ and ⁽¹²⁾

The following benefits may be obtained through a program of modular design and construction.

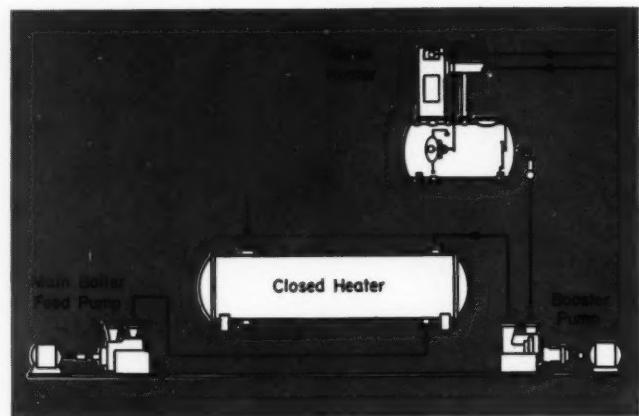
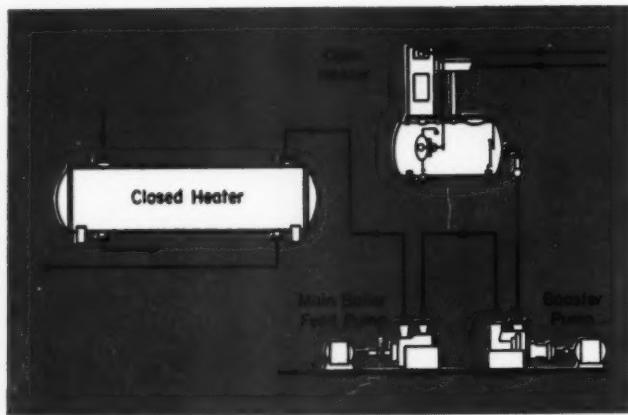
- ¶ Less repetition of work.
- ¶ Reduced supervision.
- ¶ Fewer arguments and misunderstandings.
- ¶ Faster and cheaper equipment fabrication.
- ¶ The use of standard pipe sizes, tools, gages, and equipment sizes will reduce maintenance costs.
- ¶ New personnel can be trained faster.



A MODULE IS A UNIT MEASUREMENT. IT CAN BE ANY NUMBER OF INCHES OR FEET OR OTHER UNITS:

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A BOOSTER BOILER FEED PUMP COULD BE LOCATED JUST AHEAD OF THE MAIN BOILER FEED PUMP, OR THE CLOSED HEATER COULD BE PUT BETWEEN. HAVING THE BOOSTER JUST AHEAD OF THE MAIN PUMP IS PREFERRED (LEFT).

The Booster Boiler Feed Pump Solves Space Problems

IGOR J. KARASSIK and T. W. EDWARDS

Asst. to Vice President Manager

**Consulting Engineer Boiler Feed Pump Sect.
Worthington Corporation**

ENGINEERS WHO have had contact with steam power plants aboard naval vessels are familiar with the booster boiler feed pump, which takes its suction from a direct contact heater and discharges into the suction of the main feed pump. Space aboard ship is at a premium, and there is seldom the means available to provide sufficient submergence to the boiler feed pump without a booster. However, despite the land based engineer's lack of familiarity with and acceptance of booster feed pumps, steam power plant developments have taken place recently that will force us to re-examine this subject and possibly to alter our opinion of these booster pumps.

Open Heater Elevation

One of the more vexing problems confronting the designer of a steam power plant is the physical location of the deaerating direct contact heater when an open feedwater cycle is used. Essentially, the problem is to set this heater at such an elevation that sufficient submergence will be available to the boiler feed pump under all operating conditions. Even in the past, when boiler feed pumps were designed for lower capacities, lower pressures, lower temperatures, and frequently lower speeds than today, it

was occasionally difficult to provide sufficient net positive suction head (NPSH), and oversize pumps were sometimes selected to permit handling of the lower suction head required at capacities below the point of best efficiency. Such practice is costly both from the point of view of initial investment and from that of power consumption.

The increased severity of modern service conditions has made this problem more acute and more frequent, because the trend to higher capacities, pressures, temperatures, and speeds unfavorably affects the required NPSH. The effect of higher capacities is obvious. The higher pressures mean more stages, longer shaft spans and, therefore, larger shaft diameters. This reduces the available impeller eye areas and increases the required NPSH. The higher operating temperatures are the result of higher deaerating heater pressures, and this means wider pressure fluctuations in the heater during the transient conditions that follow a severe drop in the main turbine load. These fluctuations demand greater margins over the minimum requirements established for stable operation.

Finally, the trend to higher operating speeds also means higher required NPSH. It should be noted that providing sufficient NPSH to take care of the

transient conditions strictly by increasing submergence is not always practical even at the presently conservative 3600-rpm pump speed level. This is especially true for large outdoor or semioutdoor installations and may be credited as one of the reasons for the growing popularity of closed feedwater cycles.

Booster Principle and Advantages

The principle of the booster pump is extremely simple. It is based on the installation, ahead of the main feed pump, of a low speed, low head pump, generally of single stage design, and capable of handling the required capacity with an extremely low net positive suction head. For example, consider a conventional boiler feed pump installation with a capacity of 500,000 lbs per hr at 320 F (sp gr = 0.908) and a net pressure of 1800 psi. Assume that the pump is intended to operate at 3575 rpm. Converting the flow into volume units, the pump will be designed to handle 1100 gpm. If we were to follow the recommendations of the Hydraulic Institute Standards, the pump should be provided with 45.5 ft of NPSH. To this we should add a margin as protection against transient conditions (a margin that will depend upon the design and purpose of the installation) and an additional margin for friction losses in the suction piping. We may find that the level in the direct heater needs be some 60 to 75 feet above the centerline of the pump. Whether that submergence is practical or not depends on the power plant design.

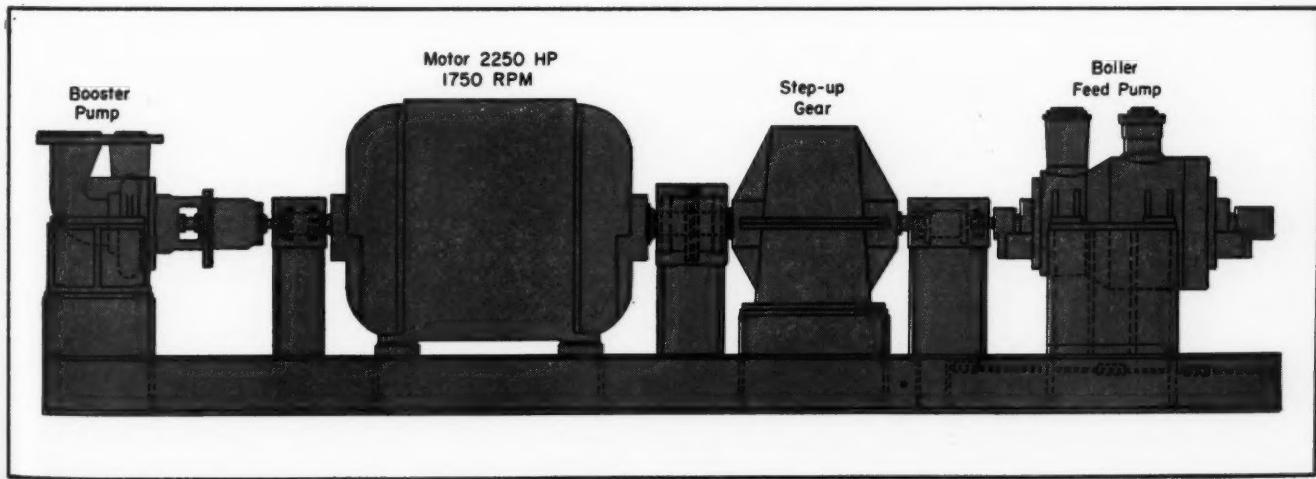
If a booster pump designed to handle the required 1100 gpm with as little as 8 or 10 ft of NPSH were interposed between the heater and the main feed pump, the location of the direct contact heater would be no problem. Thus, not only is it no longer necessary to raise the direct contact heater higher and higher as boiler feed pump NPSH requirements increase, but the heater actually can be located appreciably lower than in the conventional modern plant.

The benefits resulting from this lower location are

many. Because of the reduction in the volume of the suction pipe between the deaerating heater and the entrance to the pump, the residence time in the suction piping will be much reduced. As a result, the allowable pressure decay rate in the heater during transient conditions will be correspondingly increased. This will tend to reduce if not eliminate the bad effects of sudden drops in load at the turbine.

Furthermore, if the selected total head of the booster pump is somewhat in excess of the minimum needed to provide the required NPSH for the main feed pump, the booster pump can be permitted to go into mild cavitation under certain extreme emergency conditions. As a matter of fact the booster pump internal clearances could be made very liberal without jeopardizing the over-all efficiency, and this, coupled with the low net head developed by this pump, would mean that no damage would occur to the booster pump from occasional cavitation. Even if the total head of the booster pump were slightly reduced, it would still provide sufficient suction pressure at the main boiler feed pump so that transient conditions would not affect the ability of that pump to do its job.

Incorporating a booster pump into an open feedwater cycle and lowering the direct contact heater may become the key to the simplification of that cycle. In a normal conventional installation, the closed heaters, located in the discharge of the boiler feed pump, drain by cascading into the direct contact heater. The difference in pressure, which causes the closed heaters to drain, diminishes with the load. At extremely light loads there remains insufficient pressure to effectively drain the high pressure heaters, and a heater drain pump must be provided. These heater drain pumps must keep on running at all loads, and the excess pressure they develop at higher loads generally is throttled off by a float-controlled valve. Not only does this lead to a waste of power, but the heater drain service is actually one of the most severe of the pumping applications in a



A SINGLE MOTOR COULD DRIVE BOTH BOOSTER AND MAIN FEED PUMP IF STEP-UP GEAR WAS INCLUDED.

power plant. This is because of the high temperatures encountered and of the wide fluctuations in suction pressure and temperature.

If the use of a booster pump permits lowering the direct contact heater, it then may become possible to locate the high pressure closed heaters sufficiently above the deaerator to permit draining by gravity at all loads and to eliminate the need of heater drain pumps. Then, the use of booster pumps would not mean the addition of equipment but rather the substitution of one pump for another—and less severe service as an additional advantage.

Heater Location

A question arises once the principle of a booster pump is accepted. Why not increase the outlet pressure of the booster pump to the point that some or all of the closed heaters normally located downstream of the boiler feed pump can be moved to the suction side of that pump? This would reduce the cost of these heaters appreciably and would certainly reduce their maintenance.

There are three reasons that make such a rearrangement of the feedwater cycle less desirable than the use of a booster pump developing a nominal head just sufficient to eliminate NPSH problems. First, the basic function of the booster pump in the open feedwater cycle is to provide adequate NPSH to the main feed pump, fulfilling this function with the very minimum NPSH requirements of its own. This means that the booster pump should operate at very low speeds and, preferably, be of single stage design. Both these requirements preclude the generation of much more than 100 to 125 psi. Therefore, designing a booster pump for much higher pressures reduces its effectiveness as a booster pump.

Second, the power consumption of the main feed pump is increased by raising the operating temperature, since the power required to deliver a certain weight of water against a given pressure is inversely proportional to the specific gravity of the feedwater. For instance, a pump handling 450 F water will consume 12 percent more power than at 270 F.

Finally the higher suction pressures and temperatures at the main feed pump affect its stuffing boxes very unfavorably and pressure reducing labyrinth might be needed, with their attendant losses and additional complications. Thus, while the two-pump-in-series arrangement, with closed heaters between the pumps is not impossible, it is less desirable.

Booster Pump Drives

It can be assumed that the majority of booster feed pumps will operate at speeds of 1750 rpm and will be driven by direct connected, constant speed motors. If the main feed pump is motor driven and runs at speeds above 3600 rpm, a step-up gear will be used between the pump and the motor. In that event, the simplest and least expensive arrangement

is to use a double-extended shaft, 1750 rpm motor. One end of it will be directly connected to the booster pump and the other to the low speed shaft of the step-up gear. If separate motor drives are used, however, protective means must be incorporated that will prevent starting the main feed pump motor before the booster pump is on the line.

Steam Turbine Drive

Present indications are that the steam turbine will return to favor as a drive for large size boiler feed pumps in central steam stations. The use of motor driven booster pumps where there are direct contact heaters in the feedwater cycle will serve the added purpose of permitting the boiler feed pumps to start without motor driven standby equipment. Steam turbines driving the main boiler feed pumps will take their supply from an extraction point on the main turbine at pressures from 450 to 600 psi and temperatures under 750 F. These turbines will be noncondensing, exhausting into the feedwater heater system at about 50 to 100 psi at full load.

With this arrangement, there will be variable inlet steam pressure and temperature as well as a variable exhaust pressure with changes in load on the main unit. There will be a corresponding change in boiler feed pump power requirements and in speed. As the load on the main turbine decreases, the inlet pressure is reduced almost in a direct proportion. Therefore, at some partial station load, the inlet pressure would drop to such a value that it would become insufficient for the feed pump turbine to carry its load. Then, some auxiliary connection will have to be provided from the boiler (either directly or through a pressure reducing valve) to supply steam to the turbine whenever the extraction steam falls below a predetermined minimum.

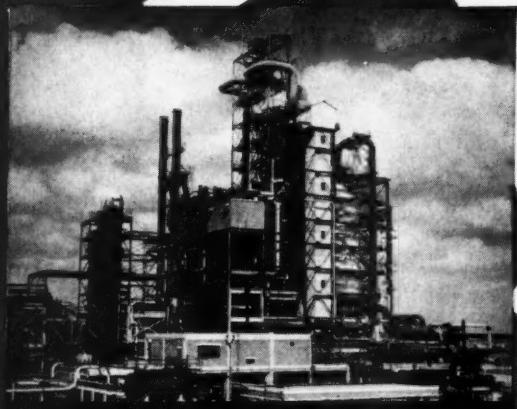
During the initial start, therefore, the motor driven booster pumps could be used to fill the boiler and to build up boiler pressure. As the boiler pressure increased, the boiler feed pump turbine could start turning, since at the reduced boiler pressure, only reduced heads and speeds would be required by the boiler feed pump. The supply of steam for the feed pump turbine during this start-up period would come either through the pressure reducing valve or through whatever other means are intended for light load operation. Then, when the main turbine is started and the extraction point pressure reaches the minimum required value, normal operating procedure takes over, and the plant goes on the line.

Bright Future

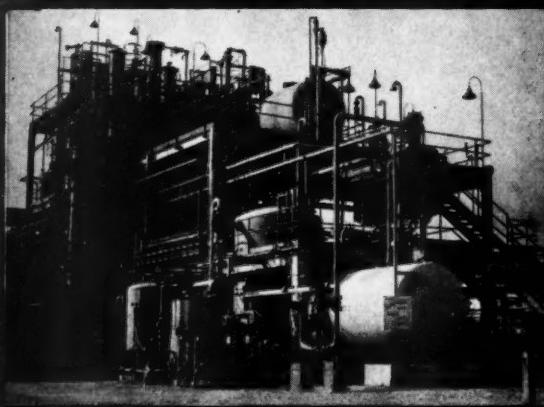
It can be seen that with all of the advantages enumerated in favor of the booster feed pump, its future looks bright indeed. This should certainly gladden the hearts of the ex-Navy men who have joined the ranks of steam power plant engineers and who have been sighing for the booster pump. ▲▲

DROP FORGED STEEL

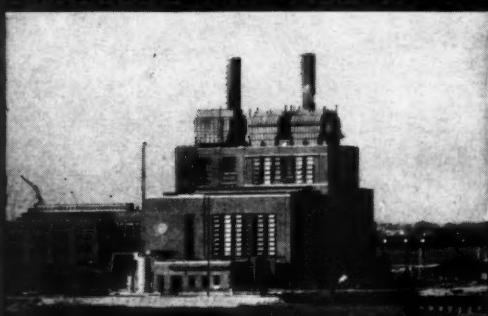
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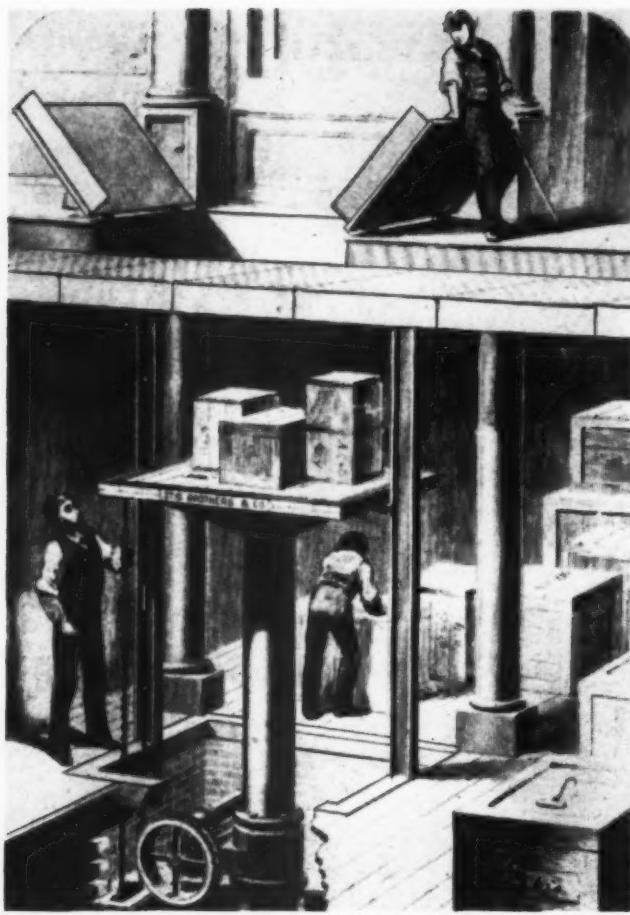
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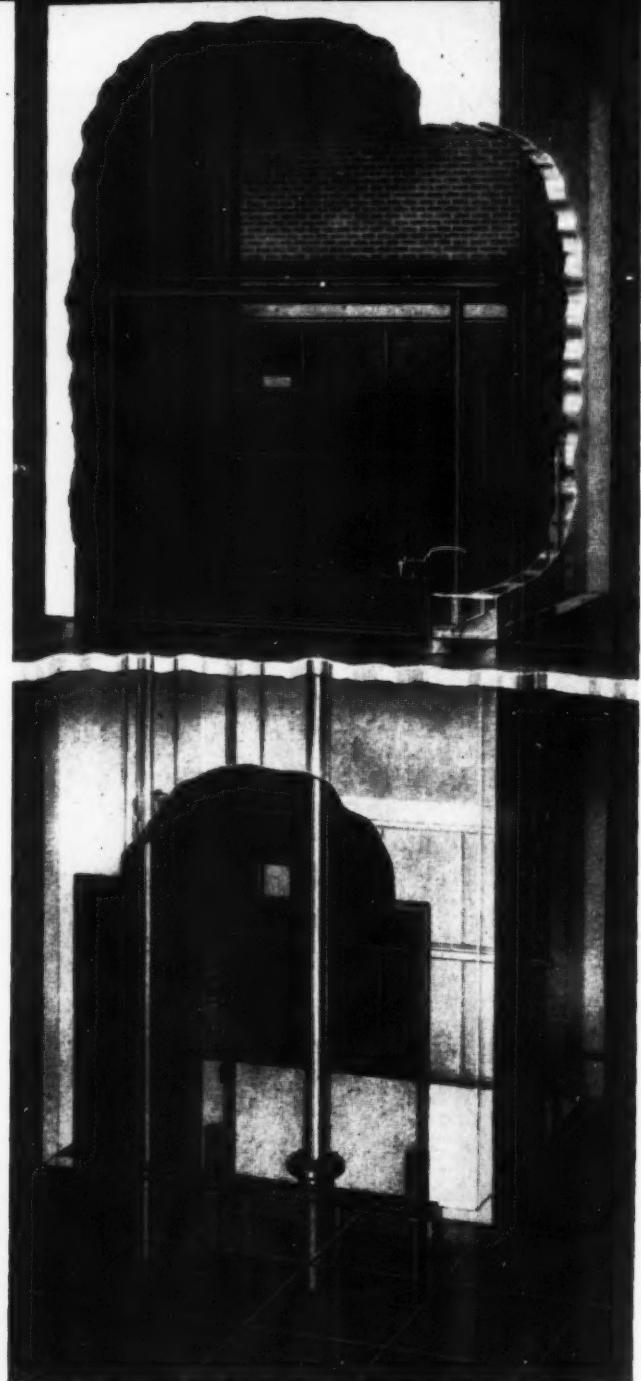
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EARLY PLUNGER TYPE MACHINE FOR HANDLING FREIGHT.



MODERN DIRECT PLUNGER TYPE HYDRAULIC ELEVATOR.

Ideas on Selection of Elevator Drives

GUSTAVE B. GUSRAE

IN 1852, Josiah Maise, of Yonkers, New York, needed a hoist for his bedstead factory. His master mechanic, black bearded Elisha Graves Otis, built one. Since then, a unique vertical transportation system has evolved that has transformed the shape of cities, changed the mode of life of many millions of men and women, and provided the initial concepts

C_e exclusive

of modern automation. Currently vertical transportation systems, encompassing more than one-quarter million elevators, serve 25-billion passengers yearly in the United States alone.

Although the maximum rate of linear speed is less than 17 miles per hour and passengers seldom travel more than a few hundred feet—sometimes as little as a dozen feet—vertical transportation provides the fantastic total of over 500-million passenger miles annually. This is five times the passenger mileage of the nation's Class A railroads. Few passengers have to wait for service more than 40 seconds, and although the vehicles or carriers are privately owned and operated, not one penny

of fare is ever collected. In addition, the accident rate is the lowest of all forms of transportation.

In New York City, over 50,000 elevators carry some 15-million passengers more than 100,000 miles through 1300 miles of hoistways every business day. This remarkable yet unobtrusive transportation pattern is repeated throughout the land on a varying scale. Yet the ready availability of vertical transportation is taken so completely for granted—like eating or walking—that few people pause long enough to discover how this Herculean task is accomplished or what *deus ex machina* makes the operation possible. Little thought is given to the many functions involved in vertical transportation or to the several currently employed hoisting methods, which are the end result of an evolutionary chain in the development of elevator mechanisms.

Elevator Drives

During the early part of the 19th century various hoisting schemes were considered, but none was good enough to acquire practical application on a wide scale. The picture changed rapidly when the plunger type hydraulic elevator was first introduced, in 1878. It was found to be safe, dependable, and comparatively smooth in operation, and it lent itself to widespread use and development. Many of the original plunger type hoisting drives are still in use today, and some currently are being manufactured for a limited application, primarily service in modern low rise buildings.

With the advent of the electric motor, in 1884, attention was turned to the development of the drum type electric machine. Actually, the drum machine first saw the light when man devised the simple hoist, the capstan, and the winch. Various types were used in monasteries, in palaces, on ships, and in warehouses, and they were first hand operated, then water powered, in turn steam driven, and finally equipped with electric motor drive. Drum type elevator use reached its peak early in the 20th century. Today it is doomed to extinction except for limited application on sidewalk freight elevators and some types of small residence elevators.

By 1904, a new hoisting principle was developed known as traction drive. The first successful installation employing this method, consisting of gearless, double wrap, traction machines, was completed by the Otis Elevator Company in the Majestic Building in Chicago. These machines were still in service in 1950.

The traction drive became an immediate success. It eliminated the cumbersome drum on which the hoisting ropes had to be wound, and it permitted building elevator hoistways as high as desired. Over the past 50 years, the traction drive has become the standard hoisting drive for modern elevators.

At present, the elevator drives generally employed are: the direct plunger machine, the electric drum



Gustave B. Gusrae, well-known elevator engineer, heads his own firm in New York City as consultant on all phases of vertical transportation work. He has actively participated in the preparation of the recently published new American Standard Safety Code for Elevators, Dumbwaiters, and Escalators. He is a member of the Sectional Elevator Code Committee, secretary of the Tests and Inspections Committee, and a member of various elevator code subcommittees, including the Parking Garage Committee now preparing the new elevator code for the many new types of automatic parking garages. Gusrae was associated with the Otis Elevator Company engineering department for eleven years and with Voorhees Walker Foley and Smith for seven years as electrical and vertical transportation consultant. He has pioneered several important elevator and escalator developments and frequently serves as an expert witness in vertical transportation court cases.

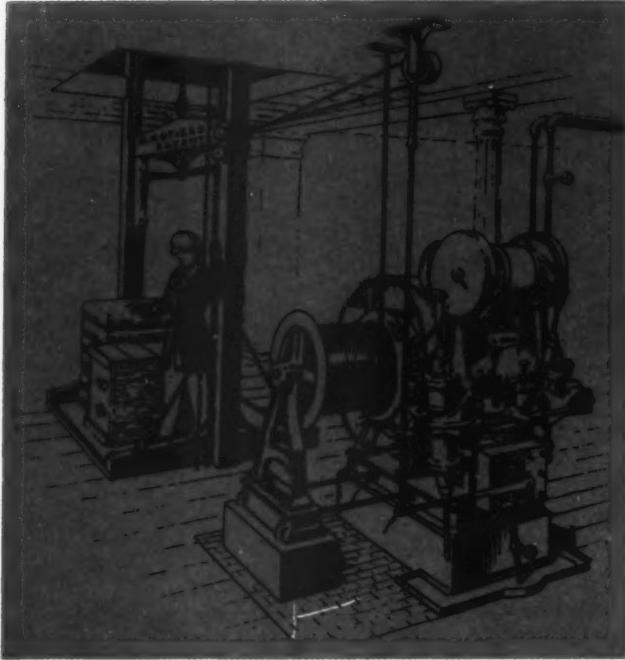
machine, the electric traction machine, and the newly revived screw machine.

Direct Plunger Machines

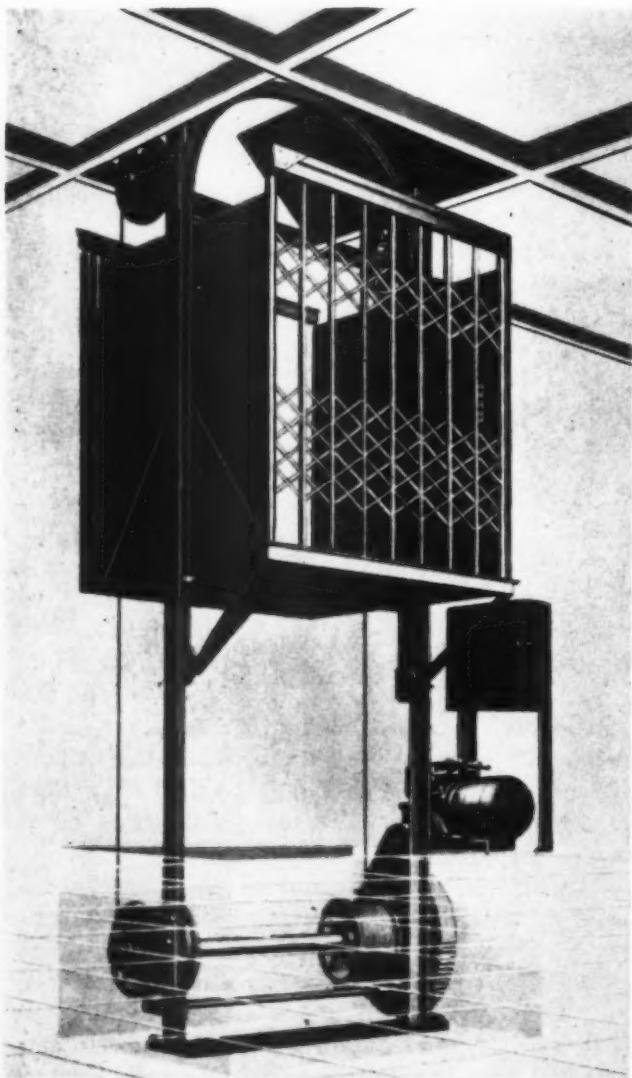
The heart of the direct plunger type hoisting drive is a long steel cylinder buried in the ground. This cylinder is about 3 feet longer than the total rise of the elevator. Air, water, or oil is forced into the cylinder under pressure so as to act upon the underside of a tight fitting plunger, which is free to move in the cylinder in an upward direction. The elevator car is mounted on top of the plunger.

A motor driven pump and tank assembly applies pressure to the air, water, or oil and forces the driving medium into the buried cylinder to raise the elevator until it reaches the desired landing. The descent of the elevator is accomplished by opening electrically a valve at the cylinder so that the combined weight of the car, the load, and the plunger can force the medium from the cylinder back into the tank. When air is used as the driving medium, the machine generally is called airdraulic; when water is used—hydraulic; and when oil is used—oildraulic.

Direct plunger machines are used mainly for handling freight and occasionally for passenger service. Total elevator rise generally is in the range up to 30 feet, although higher rises sometimes are used. Common upward speeds are in the range of 30 to 50 feet per minute for typical service conditions. A very successful application of the plunger type machine is for very short rise freight elevators



DRUM MACHINE WITH OTIS HOISTING ENGINE (1862).



MODERN SIDEWALK ELEVATOR WITH DRUM TYPE DRIVE.

at loading platforms where the load needs to be lifted a distance of 3 to 5 feet at a speed of about 5 feet per minute.

Principal drawbacks to the plunger drive are: the normal problems associated with the operation and maintenance of pumps or compressors; the possibility of leakage of the actuating medium; and the necessity of sinking a shaft in the ground under the hoistway equal in height to the rise of the elevator. In large cities with their networks of underground pipes, cables, passages, and subways, frequently it is impossible to sink the required shaft.

Electric Drum Machines

Drum type machines consist of an electric motor which, through gearing, drives a steel drum, about 3 feet in diameter and about 4 feet long with "U" shaped peripheral grooves on the drum face. One end of each of the hoisting ropes (there are usually two ropes) is fastened to the drum periphery. The car hangs at the other end of the hoisting ropes. As the drum is rotated by the motor, the hoisting ropes wind on the drum periphery, and the elevator is lifted. When the drum rotates in the opposite direction, the hoisting ropes unwind, and the elevator descends. This type of hoisting drive permitted the use of higher elevator rises at higher speeds—up to 350 feet per minute.

Practical limitations of the physical length of the drum dealt the deathblow to the drum type machine, since the rise of the elevator is restricted to the length of the hoisting ropes that can be wound on the drum. In addition, this type of machine carries the germ of inherent danger in the possibility of the elevator failing to stop at the uppermost landing. Then the revolving drum would attempt to wind the car on its periphery.

Many drum type installations are still in use today in buildings up to 16 stories in height. As the machines wear out, they are being replaced by traction type drives. The manufacture of new drum type machines, except for sidewalk and small residence elevators, has been discontinued.

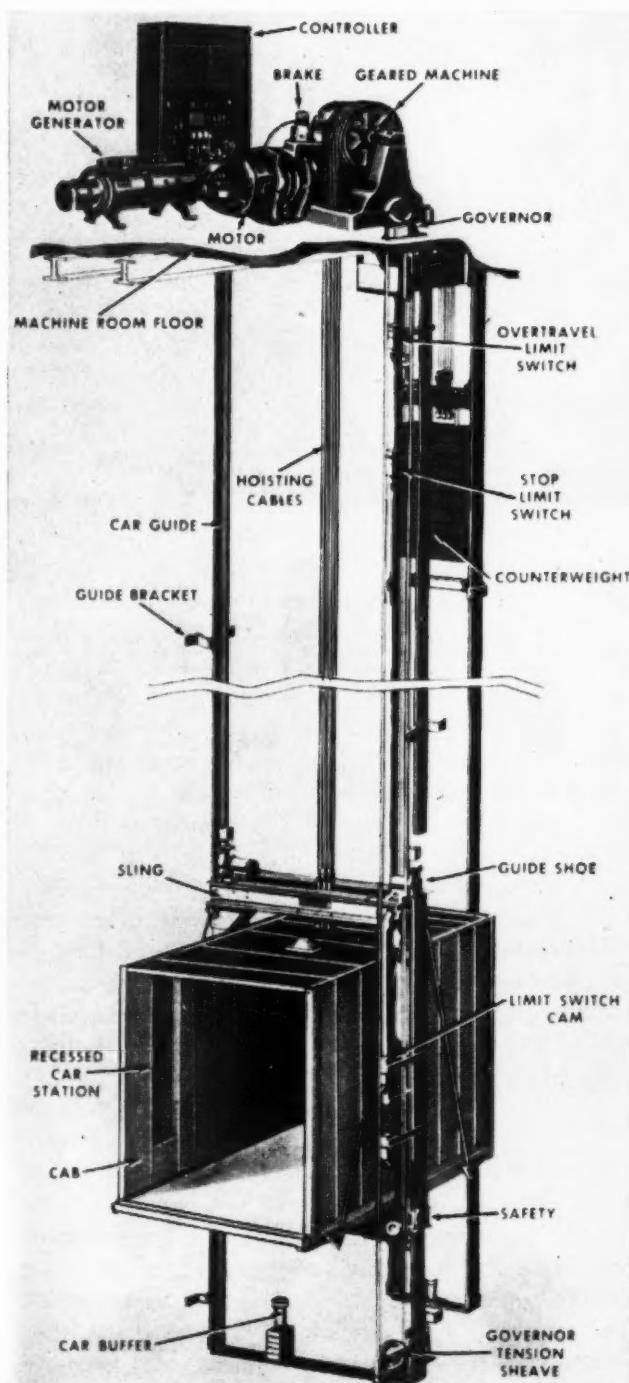
Electric Traction Machines

Traction type machines overcame the disadvantages inherent in the other types of elevator drives. With this system, the hoisting ropes are slung over a grooved sheave. The elevator car is suspended at one end of the ropes and a counterweight at the other. The frictional forces, developed through the contact between the ropes and the sheave groove walls, hold the system in equilibrium. Motion of the car and counterweight is obtained by a driving motor rotating the sheave in one direction to raise the car and in the opposite to lower it. As the car travels upwards, the counterweight moves downward and vice versa.

With the traction drive, a failure of the elevator

to stop at the uppermost landing will cause the counterweight to rest on its buffer at the bottom of the hoistway. The car then will cease to rise even though the driving sheave continues to revolve, because there will no longer be traction between the hoisting ropes and the driving sheave.

Traction drive installations are quieter and smoother in operation than any other type of drive. The rope pull is centered, and most important, the traction drive is easily adapted to operating any rise elevator at any speed. Traction drive elevators have been constructed for rises of 1000 feet and speeds



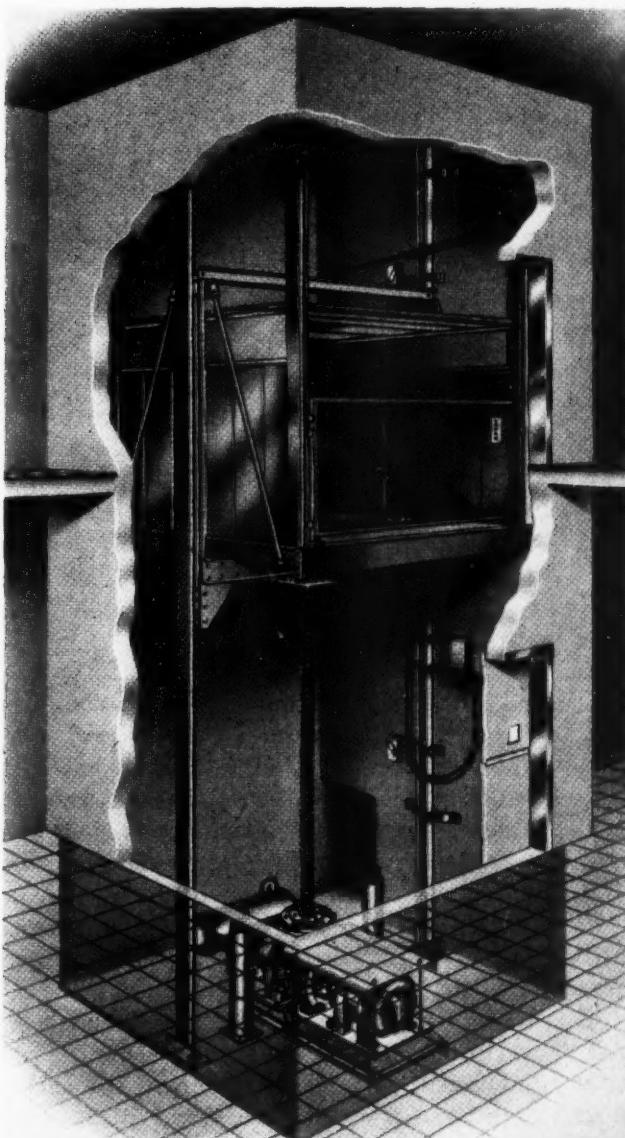
MODERN OVERHEAD SINGLE-WRAP TRACTION ELEVATOR.

of 1500 feet per minute. In view of these advantages, the traction type elevator is used in preference to other types whenever possible.

Screw Lift Machines

Recently, the screw lift drive has been revived. This mechanism operates in the same manner as the plunger machine, except that the moving plunger and the driving fluid are replaced by a nonrotating steel screw column. The car is fastened to the top of the screw column, which is raised by a rotating bronze lifting nut located at the bottom of the hoistway. The nut is rotated by a geared driving motor. Since the screw column descends into an oil filled cylinder under the hoistway, screw lift machines must have a shaft in the ground similar to that required for the plunger type elevators.

The screw lift elevator, by the nature of its construction, is designed primarily for slow speed, low rise service in the range of 20 feet. □



MODERN ELEVATOR OF THE GEARED SCREW LIFT TYPE.



Notes on Waterproofing Buildings

ELWYN E. SEELYE
Seelye Stevenson Value & Knecht

CONSULTING ENGINEERS ARE still faced with the old problem of leaks in buildings. There are even some new problems resulting from the increased use of prefabricated and precast walls. On the other hand, new sealing materials and new design techniques offer solutions if correctly applied.

Drainage of Basements

If ground water level is not safely below the lowest basement, drainage may be taken care of with a gravity flow. Generally this is accomplished with a system of footing drains or sub floor drains, or a combination of both. Where footing drains (Fig. 1) are used, they must be placed below the level of the floor of the basement so that water cannot rise to the floor level and flood the base-

ment. But they should not be placed below the lowest point of the footings, for then the flow of the drainage water could erode the soil below the footings and eventually undermine them. In some instances it may be necessary to lower the footings to avoid this condition.

Waterproofing Basements

Where the normal water level is below the floor of the basement but occasional high water is to be expected, the basement's walls can be waterproofed to a height above the high water level. A reinforced concrete mat or raft can be designed to resist the head expected. It is possible to omit special waterproofing if the construction joints are properly caulked, and a little seepage can be taken care of with floor gutters leading to sub drains.

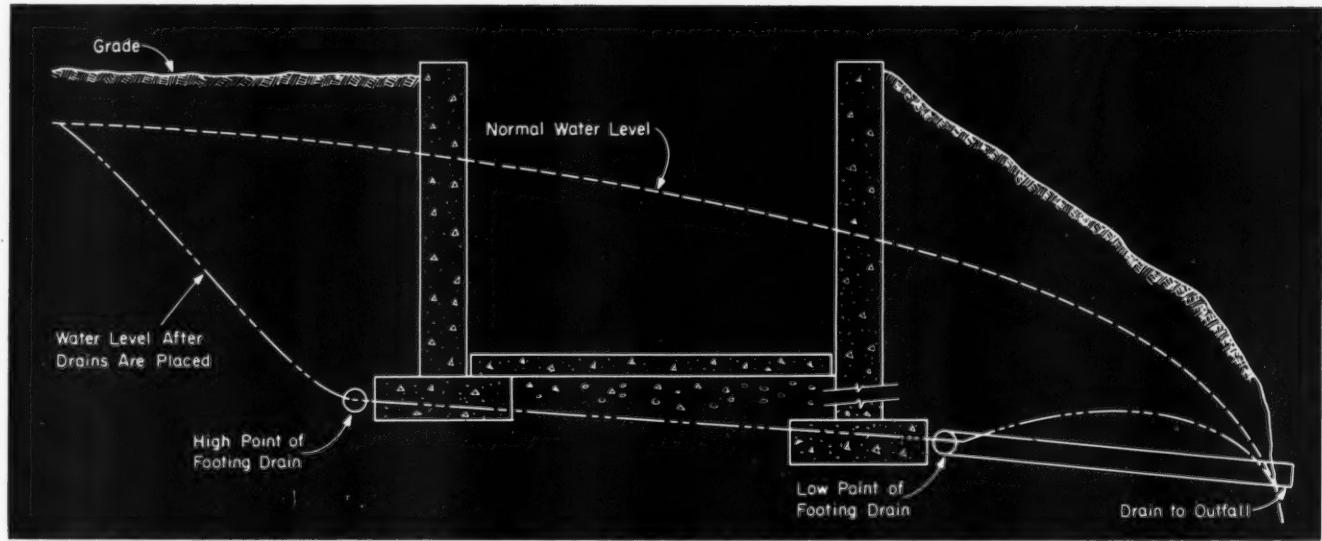


FIG. 1—FOOTING DRAINS SHOULD BE BELOW BASEMENT FLOOR LEVEL BUT ABOVE LOWEST POINT OF FOOTINGS.

If caulking of the joints between floor slabs or walls is not good enough, other methods are available. The hydrolithic method consists of the application of several coats of Ironite or similar waterproof plaster to the inside surfaces of the floors and walls. Fig. 2 shows how this plaster is applied and how the reinforcing is placed in the concrete to withstand the upward pressure.

Membrane in Basements

It is also possible to use membrane waterproofing in basements, and this is installed as shown in Fig. 3. This design has disadvantages in that any leaks that develop are inaccessible and hard to locate because the membrane is outside the walls and under the floors. It is necessary with this type of waterproofing to provide an outside or secondary wall and floor to receive the membrane.

Generally, the hydrolithic method is preferred.

Paved Areas

Membrane waterproofing can be used with success for waterproofing structures wherever the flow of water is downward. It is suited, for example to sidewalk vault ceilings. The membrane is placed between the main supporting slab and the finished

surface. The principal danger is in the possibility of leakage through the finished surface material, permitting the membrane to collect the moisture. Then, if this moisture freezes, the protective slab may heave and break, and the membrane may be destroyed by the movement of the heaving slab.

To avoid this, drains should be installed at the membrane level, and gravel or porous fill placed on top of the membrane before placing the finish surface. Fig. 4 shows how ice can break slabs and membranes when water is trapped, and Fig. 5 shows the wrong and the right way to place floor drains. Note that there is a further danger in poor design in that ice can damage and displace a parapet.

Properly designed applications of membrane waterproofing do a good job. All leakage through the concrete slab will be stopped. This is more than a convenience, it is an important protection, for leakage through concrete will corrode steel or mesh reinforcing. The dangers are shown in Fig. 6.

Vapor Seals

In the past few years consulting engineers have been paying more attention to the need for vapor seals to prevent warm, humid air from condensing on cold surfaces. If there are two adjoining air spaces separated by a partition, and the humidity is high in one and low in the other, the humidities will try to equalize themselves unless the partition is waterproofed or vapor sealed. This applies to rooms on a top story and the air above the roof.

Fig. 7 shows the right and the wrong way to vapor seal a roof. If the vapor seal is correctly placed below the insulation, the warm, moist air in the room will come in contact with a warm vapor seal protected from the outside air by the insulation. Then there will be no condensation. If the vapor seal is placed next to the roofing and outside the insulation, it will be cold and moist air in the insula-

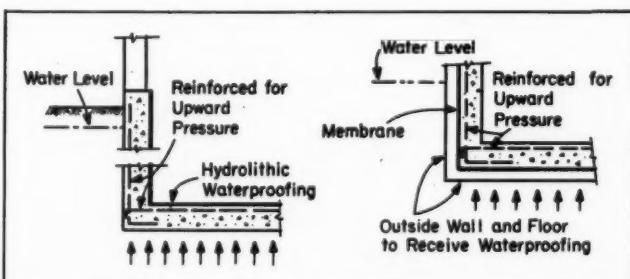


FIG. 2—USE OF HYDROLITHIC WATERPROOFING.
FIG. 3—USE OF MEMBRANE TYPE OF MATERIAL.

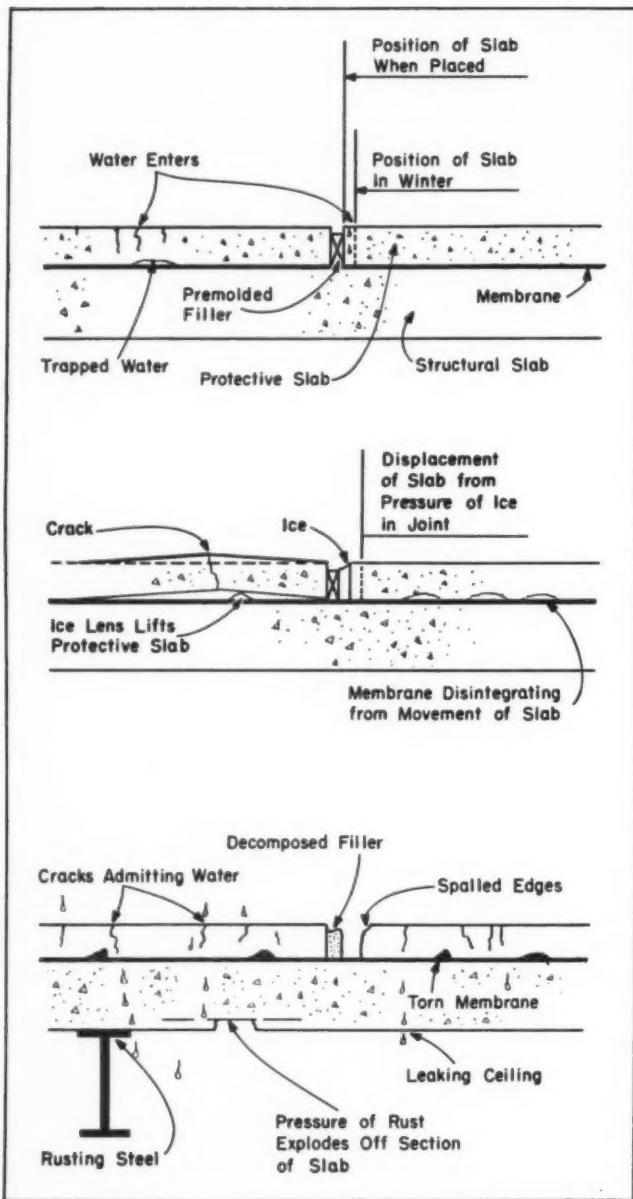


FIG. 4—WHEN MEMBRANE WATERPROOFING IS USED ON PAVED DECKS, IT SHOULD BE PLACED BETWEEN SUPPORTING SLAB AND FINISHED SURFACE. DRAINS MUST BE INSTALLED TO AVOID ICE DAMAGE.

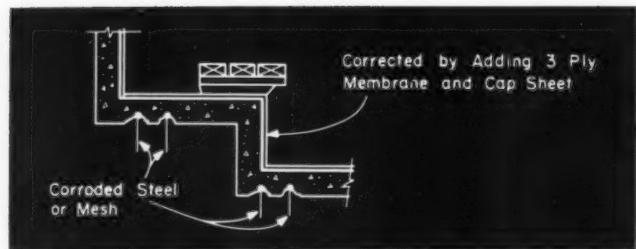


FIG. 6—LEAKAGE CORRODES REINFORCING STEEL.

tion will condense on contact. This moisture will destroy the insulation and the ceiling.

Waterproofing Walls

The answer to waterproofing walls lies in good design, workmanship, and materials. Here are several suggestions:

- ¶ Be sure bricks are laid with full beds and without voids. This requires thorough workmanship.
- ¶ Use lime cement mortar (1-1-6).
- ¶ Use a porous face brick that will give a good bond.
- ¶ Have the back of face brick parged with mortar.
- ¶ Install continuous spandrel flashing (Fig. 8.)
- ¶ Specify an independent furring.
- ¶ Coat the back of the wall with hot asphalt emulsion applied with either a spray or a trowel.
- ¶ Include drips on all overhanging edges.
- ¶ Design sills to project beyond the jambs rather than to end flush with them.
- ¶ Have face pointed with weathered or concave joints.
- ¶ Design lintel flashings to turn up at ends.
- ¶ Build preformed bituminous waterproofing units into the wall.
- ¶ After the wall is built it is wise, where possible, to pretest the construction by hosing water between the furring and the wall.

It is frequently difficult to correct a leaky wall. Driving rains can come through walls even if flashings are correctly inserted. Efforts have been

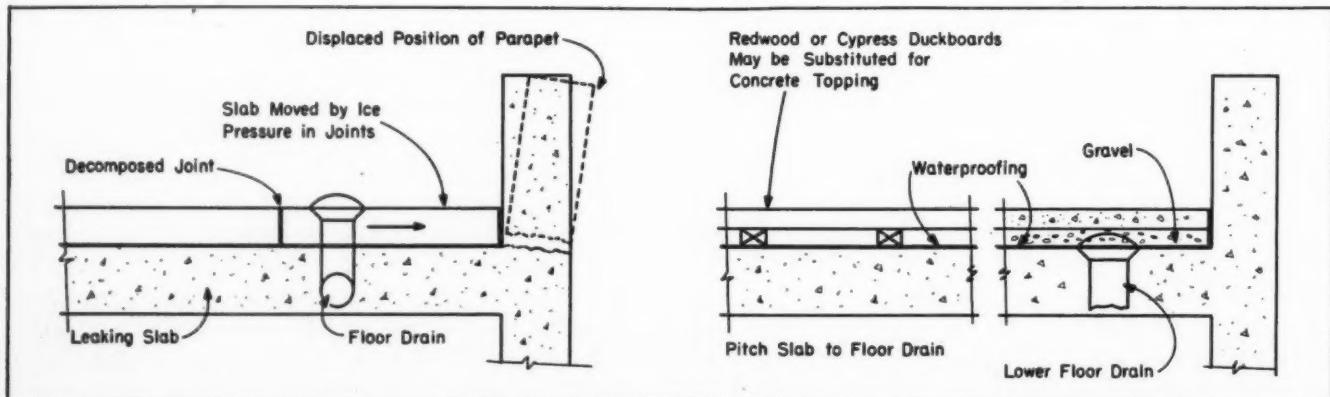


FIG. 5—THE WRONG (LEFT) AND THE RIGHT WAY TO INSTALL FLOOR DRAINS IN CONCRETE STRUCTURAL SLABS.

made to correct such leaky walls by waterproofing them with paraffin or colorless silicone coatings, but permanent success is doubtful.

Perhaps the most difficult type of leak to control is one where the water comes down the inside face of the wall and reaches the floor to spread out and stain the ceiling or the wall below. Frequently, attempts are made to control this condition with a spandrel flashing, but this is not often successful. If there are no weep holes in the wall to permit the water to drain, and if there is no continuous metal furring to act as a gutter, the problem is difficult.

Waterproofing Parapet Walls

Fig. 9 shows how a parapet wall can be properly designed. Note that a through-wall cap flashing is used to seal off the water and lead it down from the upper part of the parapet. Do not use a bituminous coating. It will seal the water in, and when it freezes, the brick will shale off. It is also a good idea to use face brick or a hard burned brick on the rear of parapet walls.

It is particularly important to anchor the parapet to the main wall with dowels or masonry offsets to prevent creeping. Corners are the most vital points.

Prefabricated Metal Walls

Since prefabricated walls are relatively new and many new organizations have started to produce them, it is best to select manufacturers and erectors who are experienced. In specifying the walls, in-

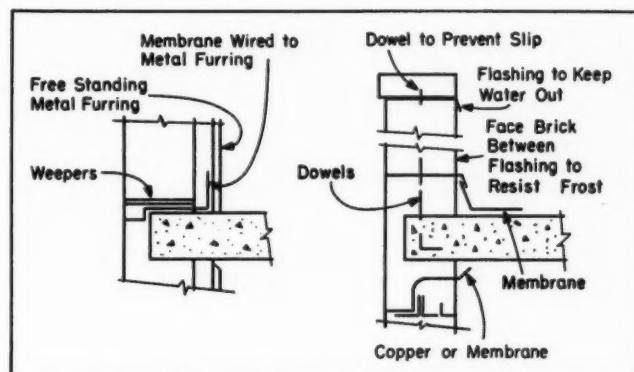


FIG. 8—USE OF CONTINUOUS SPANDEL FLASHING.
FIG. 9—WATERPROOF DESIGN OF A PARAPET WALL.

vestigate the product to be sure the design has the following characteristics:

- ¶ Is waterproof.
- ¶ Can withstand wind pressure without buckling.
- ¶ Has provisions for expansion.
- ¶ Is provided with some means to drain condensate.
- ¶ Does not include dissimilar metals so placed as to encourage electrolytic corrosion.

In the erection of the walls, it is usually wise to use a mastic filler at the folded or lapped seams. Generally these metal walls are backed with a masonry wall and have insulation in between.

Precast Masonry Units

There are several problems in connection with precast masonry units. Be sure that exposed concrete is waterproofed with integral waterproofing, otherwise the surface will be spotted after a rain.

Horizontal joints can be tongue-and-grooved in such a way as to throw out water coming down the surface. Vertical joints are more of a problem. Currently, most designers depend on mastic or cement to caulk the joints, but there is considerable shrinkage and temperature expansion and contraction. While manufacturers make strong claims, there do not seem to be any permanent synthetic elastic cements available.

One suggested solution is the use of live or foam rubber in vertical joints as shown in Fig. 10. This should make a satisfactory seal. ▲▲

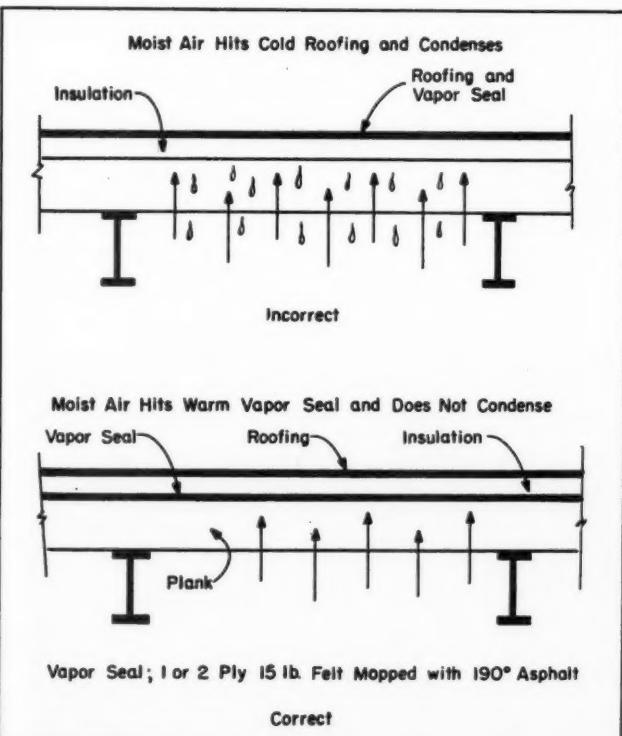


FIG. 7—VAPOR SEAL SHOULD BE INSIDE INSULATION OR CONDENSATION WILL DESTROY THE CEILING.

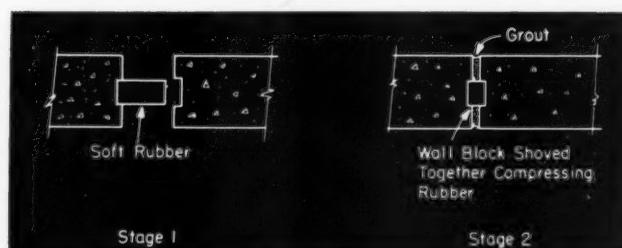


FIG. 10—SUGGESTED METHOD FOR WATERPROOFING A VERTICAL JOINT IN A PRECAST MASONRY WALL.

FOAMGLAS®

the cellular, stay-dry insulation



STAYS DRY — Cut a piece from your sample. Place it in water. Note how the hermetically-sealed glass cells filled with dead air keep it afloat. Weight it down for days, weeks or longer

VAPOR-PROOF — With a nail file, cut a $\frac{1}{4}$ " thick slice from your sample. Hold it to your lips and try to blow smoke through it. The smoke won't penetrate . . . proof that FOAMGLAS is a positive vapor barrier in itself.

STRONG AND RIGID — Place your FOAMGLAS block on the floor. Stand on it. Note how it supports your weight without crushing. Compressive strength is over seven tons per square foot . . . making it ideal for load bearing applications.

if you like. Remove the weight and it bobs back to the surface . . . proof that the sealed cells have absorbed no water, still have their original insulating efficiency.

WON'T BURN — Hold a flame to your sample. You'll see at once that it does not burn . . . an important safety feature in all construction. It's even acid-proof and rodent-proof as you can prove if you happen to have a vial of acid or a pet rat handy.



Send for a sample and make these simple tests!

Prove to yourself that FOAMGLAS is your ideal insulation!

Let us send you a free sample of FOAMGLAS. Use it to make the few simple tests illustrated. You'll prove that this unique cellular glass insulation has exactly the right combination of properties to assure you of these vital benefits: constant insulating efficiency . . . long, maintenance-free life . . . strength and rigidity for a variety of structural applications . . . ease of handling and installation.

Thousands of actual users have proved in actual performance the benefits so clearly demonstrated by these tests. No wonder, then, that new users every

day are picking FOAMGLAS to insulate the roofs, ceilings, walls and floors of all types of buildings, low temperature spaces, piping and equipment. Send for a sample today and make your own tests. Use the handy coupon, or write . . .

Pittsburgh Corning Corporation

Department R-26, One Gateway Center

Pittsburgh 22, Pa.

In Canada: 57 Bloor Street West, Toronto, Ontario

LIGHT WEIGHT — Just pick up your sample to see how light and easy to handle it is. Check actual weight on your company's postal scale if you wish. The density of FOAMGLAS is only 9 pounds per cubic foot.

EASY TO SHAPE AND CUT — Shave some strips off your sample with an ordinary paper clip . . . workmen use knives, saws or trowels for quick shaping and fitting on the job.



Pittsburgh Corning Corporation
Dept. R-26, One Gateway Center
Pittsburgh 22, Pennsylvania
In Canada: 57 Bloor St. W., Toronto, Ontario

Please send me a sample of FOAMGLAS for testing.

Name _____

Company _____ Title _____

Address _____

City _____ Zone _____ State _____

Improved Filing System for Catalogs

EVERY CONSULTING ENGINEER is a regular user of manufacturers' catalogs, bulletins, and descriptive literature. In

Cp exclusive
fact it is next to impossible to undertake the design and specification of equipment for even the simplest project without reference to some manufacturer's catalog. However, these catalogs are by no means ideal reference material. Every manufacturer has a different idea as to how his publications should be bound, and what the proper size should be, and what material should be included. These publications are hard to file, hard to classify, and, consequently, hard to locate when needed.

Probably the best filing system so far devised for filing manufacturers' catalogs is the American Institute of Architects Standard Filing System, a system widely used in consulting engineers' offices. AIA has published a booklet (\$2.00 a copy) describing this system and giving code numbers for all materials and equipment commonly specified by architects or consulting engineers. The system is quite simple. AIA has selected Major Division numbers that conform to those usually included in a com-

34. POWER PLANT.
34-A. General Design and Engineering Data.
34-B. Boiler Room Equipment.
34-B-1. Boilers and Accessories. (Including Condensate Return Units.)
34-B-11. Steam Purifiers.
34-B-12. Water Columns.
34-B-13. Strainers.
34-B-14. Gauges.
34-B-15. Boiler and Piping Conditioning Compounds.
34-B-2. Condensers.
34-B-3. Economizers.
34-B-4. Super-Heaters and Mechanical Draft.
34-B-5. Grates
34-B-6. Stokers (<i>For Heating, see 30-G-3</i>)
34-B-7. Tube Cleaners and Separators. (Including Blower and Vacuum.)
34-B-8. Fuel Oil and Powdered Coal Equipment. (<i>For Fuel, see 30-G.</i>)
34-C. Coal and Ash Handling.
(<i>For Ash Collection and Removal for Heating, see 30-i. For Ash Hoist, see 30-i-1.</i>)
34-C-1. Conveyors.

FIG. 1—A SECTION SELECTED FROM THE AIA STANDARD FILING SYSTEM MANUAL SHOWING HOW POWER EQUIPMENT IS CLASSIFIED AND SUBDIVIDED.

STANDARDS AND CODES. (General)	40-B
STEAM	
Conduit Systems	30-C-6
Engines	34-H-1
Flow Control Valves	34-E-1
Heating Systems (General)	30-C
Pressure Regulators	34-G-3
Purifiers	34-B-11
Water Heaters	29-D-2
STEEL, Ornamental	15-H
Porcelain Enamelled	15-H-2
Stainless	15-H-1
Structural Metals (Major Division)	13
STEEL PIPE AND FITTINGS	29-B-3
Welding Pipe	29-B-31
STENCILING AND GESSO: (Decorative Painting)	25-D-2
STERILIZERS, Water	29-D-33
STILL AND MOTION PICTURE EQUIPMENT	35-A-2
STOCK AND TOOL STORAGE	35-i-15
STOKERS	
Heating Boilers	30-G-3
Power Plant	34-B-6
STONE AND SLATE ROOFING	12-D
Graduated	12-D
STONE WORK. (Major Division)	8
Artificial	8-C
Carving and Sculptural Work	8-D-1
Clamps and Anchors	8-E-1
Cleaning	8-E-3

FIG. 2—AIA MANUAL ALSO HAS AN ALPHABETICAL CROSS-INDEX, A PORTION OF WHICH IS SHOWN.

prehensive construction and mechanical equipment specification. (see example at left). Under these Major Divisions, there are subdivisions designated by capital letters. Under the Major Division "34—Power Plant," there are eleven subdivisions, such as: "34-A—General Design and Engineering Data," "34-C—Coal and Ash Handling," on through "34-J—Dams and Water Power." These subdivisions are further subdivided to give a code number to specific materials or equipment.

The AIA Standard Filing System Classifications and File Numbers are remarkably complete as printed, but it would be a simple matter to add numbers to cover every item specified by a consulting engineer or even to add Major Divisions beyond the 41, if desirable.

In using this system, every bulletin or catalog received in the office is given a File Number found in the AIA Filing System Manual. Then, the bulletins are filed in the order of this File Number. This would put all bulletins dealing with the same type of product together: all catalogs on boilers in one place, all catalogs on electrical equipment in another, and all

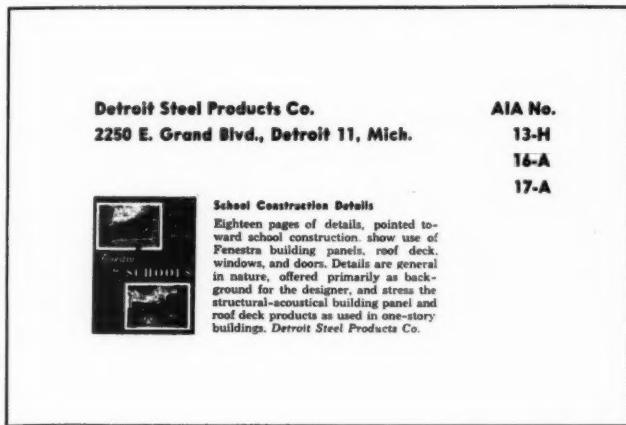


FIG. 3—THESE 4X6 MANUFACTURERS' INDEX CARDS ARE TO BE FILED ALPHABETICALLY BY MANUFACTURERS NAME. THEY WOULD SUPPLY THESE CARDS.

structural metals in another—with each of the divisions subdivided as far as is necessary.

This sounds as though it would work well, and it is an excellent system—so far as it goes. Drawbacks are fairly obvious. Unless a complete record is kept, a person looking for all the piping catalogs, for example, would have no way of knowing if one or more had been removed from the file. An even more serious difficulty is brought about by the fact that many manufacturers include in one catalog several different types of products that they manufacture. In order to file properly, either there would have to be duplicate catalogs filed for each type of equipment, or cross-reference cards would have to be put in each classification to tell where the single copy of the catalog was filed. Furthermore, no matter how excellent an indexing method, some items of equipment refuse to be indexed concisely, and this means frequent reference to the AIA Standard Filing System Manual to ascertain all possible divisions under which the catalog could be filed. Following this an actual physical search would have to be made of all likely divisions in the catalog file.

It also has been noted by many engineers that the concept of filing by product groupings, while theoretically ideal, is not as convenient in practice as having bulletins filed alphabetically by name of manufacturer. When working on familiar projects, the engineer usually knows which manufacturer's equipment he wants to specify, and he could find the catalog easiest by going to an alphabetical rather than a number code file.

NYACE Committee Work

A committee of the New York Association of Consulting Engineers has been studying this matter of catalog filing for some time. They have come up with an answer that promises to provide the consulting engineer office, large or small, with a filing system to fit its needs.

The NYACE Committee came to the conclusion

FIG. 4—PRODUCT INDEX CARDS ARE FILLED OUT IN ENGINEER'S OFFICE. THEY ARE FILED ALPHABETICALLY OR ARE FILED ACCORDING TO AIA NUMBER.

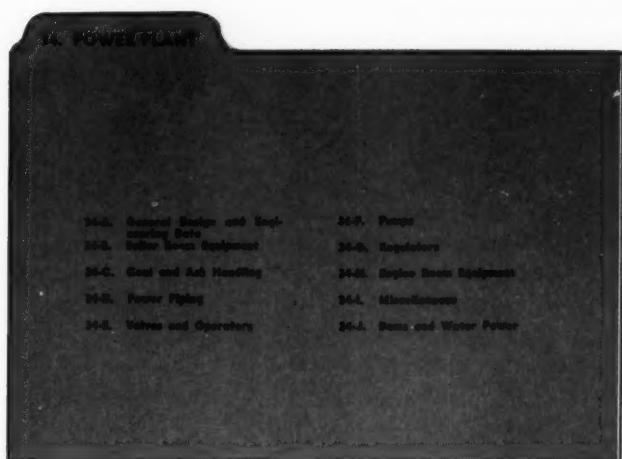


FIG. 5—WHEN PRODUCT CARDS ARE FILED BY AIA NUMBER, MAJOR DIVISION SEPARATOR CARDS ARE USED. THEY LIST MAJOR DIVISION SUB DIVISIONS.

that the basic AIA System is excellent, but it needs the addition of cross-indexing cards to make it ideal for consulting engineers. Two sets of 4x6 indexing cards would be required. One set would make up the Manufacturers' Index (Fig. 3) with one card for each catalog in the files. The manufacturer's name would be at the top of each card, and below his name would be a short description of the catalog, giving a list of all products in the catalog with their AIA number. These index cards would be filed alphabetically by manufacturers' names.

The second set of indexing cards (Fig. 4) would be a Product Index, in which the product name and AIA number would appear at the top of the card followed by a listing of all manufacturers who make that product and who have catalogs in the file. These cards could be filed by AIA numbers or alphabetically, depending upon which of two systems was selected for filing the catalogs, themselves.

If the consulting engineer preferred to continue to file catalogs by AIA number, the 4x6 Manufacturers'

Cards would be filed alphabetically by company name, while the Product Cards would be filed alphabetically by product name. (There is an alphabetical index published in the AIA Standard Filing System Manual. (See Fig. 2) and this would be the basis for setting up the alphabetical Product Card Index.) Using this system, the engineer who wanted to know what catalogs he had from a particular manufacturer would go to the Manufacturers' Index Cards and look up the manufacturer's name. Here, he would find a card for each catalog in his file from the manufacturer and a short description of the material in the catalog would appear on the card. The AIA number under which each catalog was filed would be shown on the card, and the catalog could be located by number.

If the engineer were interested in a particular product, feed water regulators, for example, he would go to the Product Index, and look alphabetically for "Feed Water Regulators." He would find on that card the names of the manufacturers of feed water regulators whose catalogs he had available in his file, and he would also find listed the AIA number (34-G-2 in this instance) so that he could locate the catalogs without trouble. The use of this system would eliminate the necessity of going to the AIA Manual to locate the File Number, and would show at a glance the catalogs on the subject in the file. If he preferred, the engineer could take the names of the manufacturers from the Product Index and look them up in the Manufacturers' Index, finding there a brief description of each catalog. Here he could select just those catalogs dealing with the particular type of product in which he was interested.

Catalogs Filed Alphabetically

A second and perhaps better system would be to file the catalogs by manufacturers' name rather than by AIA number. Again, the Manufacturers' Index cards would be filed by manufacturers' names, but using this system, the Product Card Index would be filed by AIA Number. If this system were used, it would be necessary to make occasional use of the AIA Alphabetical Index as published in the Standard Filing System Manual. For example, if the engineer wanted to get all the catalogs on oil burners, he might have to go to the AIA Alphabetical Index to learn that Oil Burners are numbered 30-G-1. Then he could go to that number in his Product Card Index and find all the names of manufacturers.

This reference to the AIA Manual could be eliminated in most instances by inserting separator cards in the Product Card Index, each separator giving the subject of an AIA Major Division, with subdivisions and AIA Numbers printed below on the card. (Fig. 5) Then anyone who would judge that Oil Burners would be under the Major Division "30—Heating, Ventilation, Air Conditioning and Refrigeration" would note that heading on the separator card

and could then find "Oil Burners" listed as 30-G-1.

This system does have the very distinct advantage of having the catalogs, themselves, filed alphabetically by manufacturer's name. Since most references to catalogs are the result of a need for a particular manufacturer's publication, the user can go directly to the file and select the catalog without further ado. When filed by AIA number, there is always the need to look in some cross-reference file or the AIA Manual to translate product to code number. Then too, when filing by AIA number, one manufacturer may have a number of catalogs scattered throughout the file. Filing by manufacturer's name keeps all of his catalogs in one place.

This system of filing catalogs by manufacturers' names is the one recommended by the New York Association of Consulting Engineers.

Manufacturers Supply Cards

The New York Association of Consulting Engineers now is starting a program to encourage manufacturers to supply along with each of their catalogs a pair of cards, one for the Manufacturers' Index and one for the Product Index. This is a laudable project, but it is doubtful if it could be accomplished for even a small percentage of the manufacturers of engineering equipment and materials—over many years. It does offer an opportunity to the wise manufacturer who recognizes the advantages of having his catalog listed in a cross index in an engineer's office.

Certainly, it would cost very little for each manufacturer to attach a Manufacturers' Index Card to each of his bulletins when it is mailed to a consultant's office. This might be done by a great many manufacturers with just a little encouragement. On the other hand, the inclusion of a Product Index Card with each catalog seems impractical. The Product Index Card lists the product by AIA number, and on this card should be shown the names of all manufacturers who make such products and who have catalogs in the file. One manufacturer could hardly be expected to supply the names of his competitors, and he would have no way of knowing which of his competitors catalogs were in the engineer's file even if he felt like listing them. Then too, catalogs frequently carry data on more than one type of product, and then separate Product Index Cards would have to be printed for each classification.

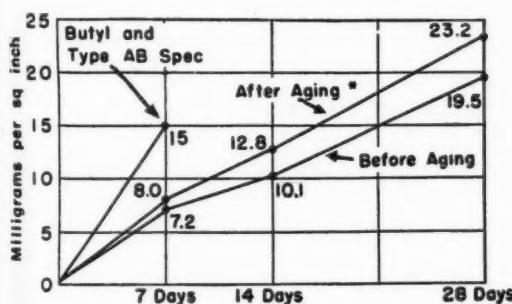
This is no real handicap. A set of printed separator cards could be made available commercially for the engineer's Product Index, and then the engineer's office could prepare the actual Product Index Cards. Only one card would be required for each product classification, and as catalogs were received in the office, it would merely be necessary to add the name of the manufacturer to the proper Product Index Card. If the manufacturer supplied the Manufacturers' Index Card with the catalog, the system would be complete.



Amazing moisture resistance of Anaconda's Type AB butyl high-voltage insulation helps reduce failure due to moisture.

When you can't keep cable out of moisture New insulation keeps moisture out of cable

Exceptional moisture resistance is provided by Anaconda Type AB butyl insulation.



RESULTS OF mechanical moisture absorption test show Type AB retains good moisture resistance even after aging.

Where rubber-type cable is installed in underground ducts or buried directly in the earth, the moisture-resistance properties of the insulation are vitally important.

Latest facts show Anaconda's Type AB butyl high-voltage insulation absorbs far less moisture than industry standards permit. For the mechanical moisture absorption test, the industry has regarded 15 milligrams increase in weight per square inch of exposed surface, after 7 days' immersion at 70C, as a criterion for satisfactory moisture resistance. Type

AB easily meets that requirement — in fact, typical results show it absorbs less than 7.2 mg. in 7 days.

New Engineering Bulletin EB-27 gives you full details on performance of Type AB insulation in 15 Industry Specification tests. Ask the Man from Anaconda for your copy. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

56296

Get all the facts on
Anaconda butyl. Write today —

ASK THE MAN FROM **ANACONDA®**
—PIONEER IN **BUTYL INSULATION**

Any engineer
will tell you
Skidmore
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pump performance



There's a wide range of types and capacities for every heating pump need. Let Skidmore advise you on your next tough job.

TYPE UV

Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

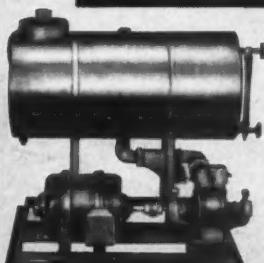
Write for **Bulletin No. 19-A**



TYPE HS

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

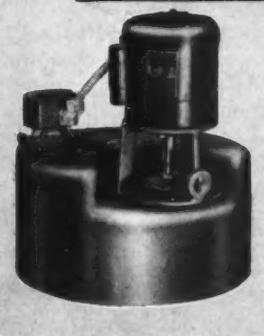
Write for **Bulletin No. 14-A**



TYPE TM

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

Write for **Bulletin No. 17**



TYPE CVS

The Skidmore Type CVS condensate pump combines the latest features in centrifugal pump design. Mechanical shaft seal eliminates all leakage from pump shaft. Range of selectivity from 500 to 10,000 sq. ft. EDR—with discharge pressures from 20 to 40 lbs. Send today for new bulletin on complete technical data. Write for **Bulletin No. 21-B**

Sales representatives in principal cities

SKIDMORE PUMPS
SKIDMORE CORPORATION, ST. JOSEPH, MICH.

Consultants To Visit Europe



PRELIMINARY PLANS are now being made for a trip to Europe for a party of consulting engineers during the month of May, 1956. The tour will be set up so that in each of the countries visited, the American consultants will meet with the local Association of Consulting Engineers.

As currently planned, the tour would leave New York on the evening of April 29 (with morning pickups in San Francisco and Chicago), arriving in London on Monday, April 30. Return would be from Paris on May 27, with stops in New York, Chicago, and San Francisco on the following day. In between, the group would visit England, Holland, Germany, Switzerland, and France.

Wives are more than welcome, and a special program of interest will be arranged—teas at embassies, visits to points of interest, and special showings at the salons of fashion leaders. While a complete program will be available, no one will be required to follow a formal tour schedule. If, for example, a few days on the Riviera are more appealing than a sojourn in the Alps, that can be done.

If you would like to make the tour, fill in the coupon below immediately and mail it to CONSULTING ENGINEER. You will be sent all the information currently available on the programming and estimated costs. Get together a group from your office or your local consulting engineer's association.

Consulting Engineer

227 Wayne St., St. Joseph, Michigan Self only

Party of ...

Send further information on the European Tour.

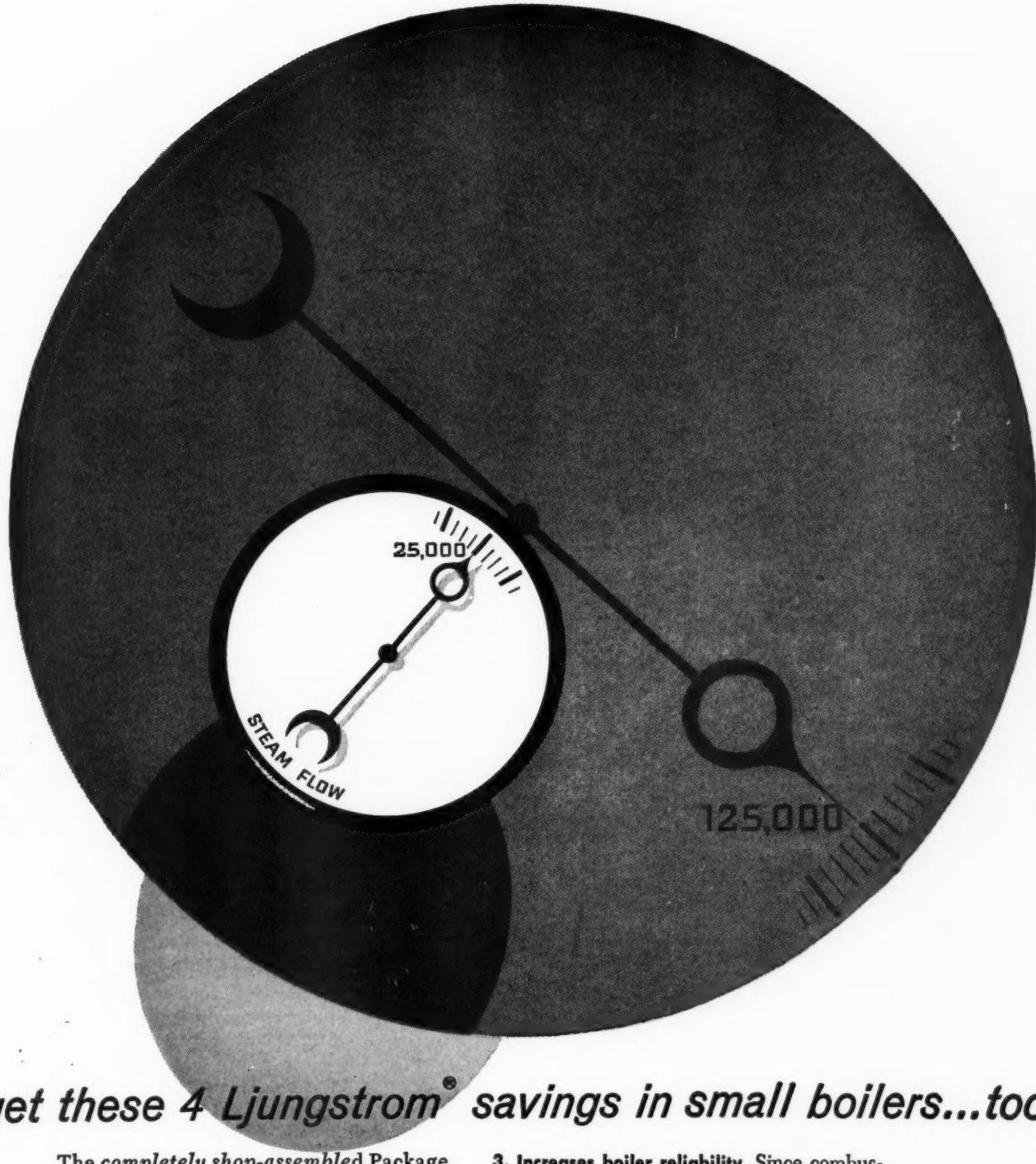
Name _____

Title _____

Firm Name _____

Address _____

City and State _____



get these 4 Ljungstrom® savings in small boilers...too!

The completely shop-assembled Package Ljungstrom Air Preheater brings to boilers as small as 25,000 pounds of steam per hour the four proved advantages of regenerative preheating:

1. Saves fuel. This reduction in fuel consumption can be sizeable . . . and can write off the cost of the unit in about a year. For in most installations yearly fuel costs match the initial cost of the boiler.

2. Boosts boiler output. Preheated air intensifies the combustion process. Heat absorption into boiler tubes increases correspondingly, raising the unit's capacity to produce steam.

3. Increases boiler reliability. Since combustion is more efficient — fuel is burned more completely . . . there's less slagging . . . boilers stay on line longer. What's more, stack gases should be cleaner.

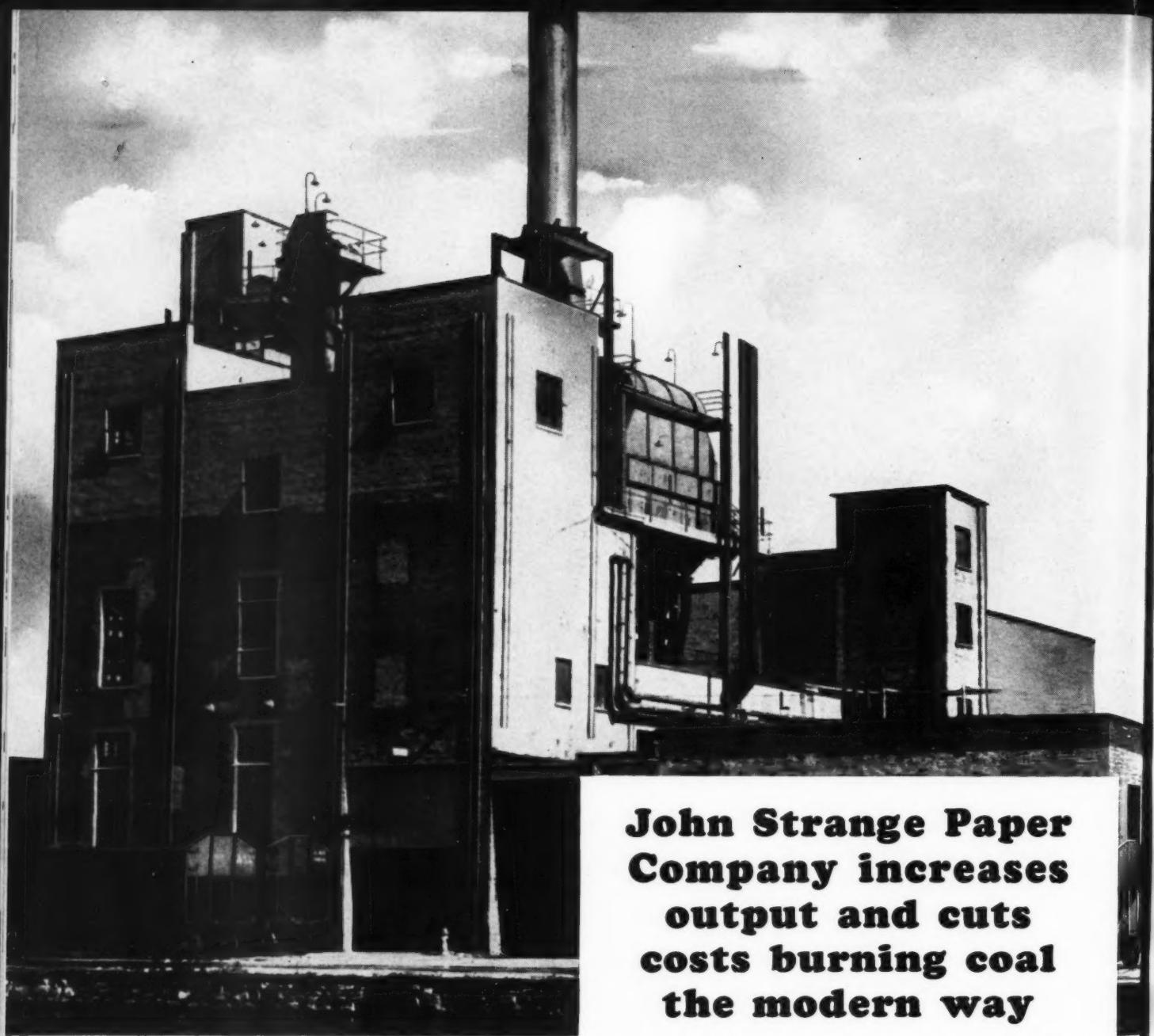
4. Burns lower-grade fuels. Higher furnace temperatures make practical the burning of lignites and similar low-grade fuels.

Find out how the efficient, low-cost Package Ljungstrom Air Preheater can be applied to your steam-generating units. Write, today, to The Air Preheater Corporation.



The Package Ljungstrom operates on the continuous regenerative counter-flow principle. The heat-transfer surfaces on the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming combustion air.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.



John Strange Paper Company increases output and cuts costs burning coal the modern way

Steam and electric power represents a considerable percentage of overall costs in paper mill production. In addition to this cost problem, the power plant of the John Strange Paper Co., Menasha, Wis., lacked sufficient capacity to meet the mill's demand for steam and power.

In an effort to trim costs and increase capacity, the company called in the consulting firm of Cummins & Barnard, Inc., Ann Arbor, Mich., to recommend a modernization program. Based on those recommendations, today John Strange burns coal in highly efficient steam-generating equipment. The remodeled installation includes completely modern coal-handling and pneumatic ash-handling equipment as well as two automatic control systems. Costs have been curtailed; steam and power supply is dependable. Most important, the mill machinery operates at higher speed, resulting in a 10% increase in production.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

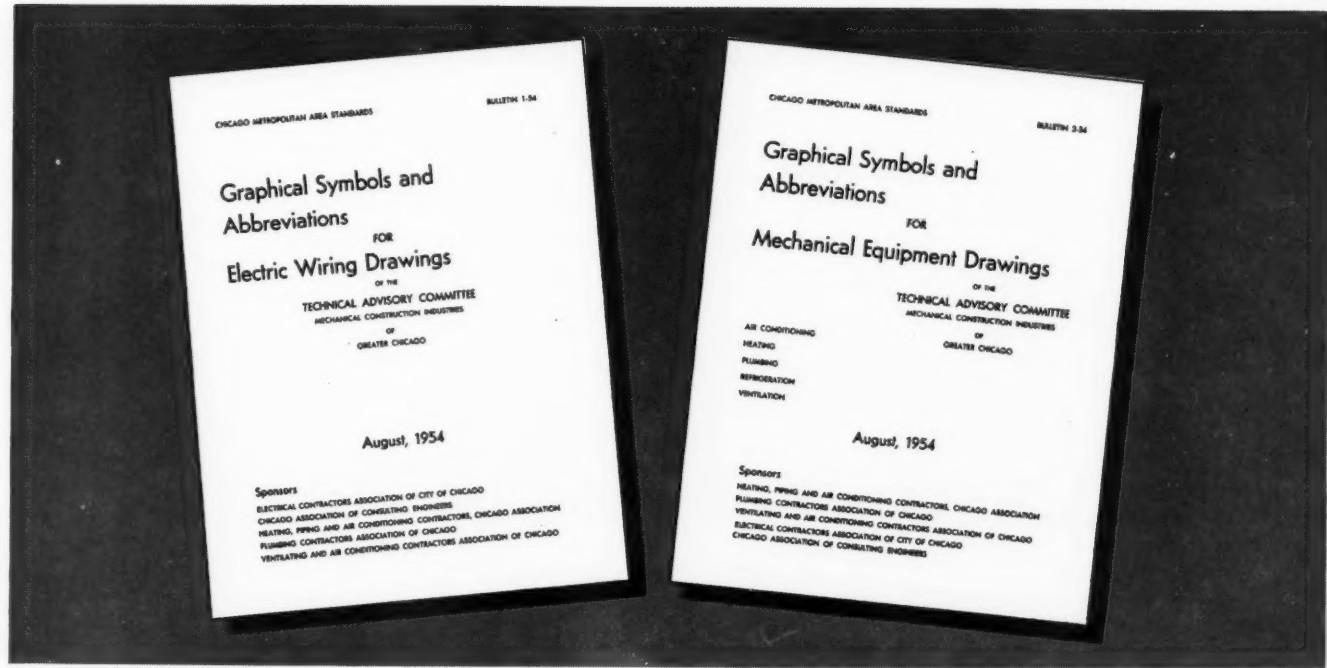
NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D. C.

Note to Consulting Engineers:

Many companies planning a new power plant, or the remodeling of a present one, consult an engineering firm on its design and construction. When you have such a project, our Engineering Department will be glad to assist you in your fuel cost survey with any coal information you may require. In most cases, for the reasons listed below, the use of coal results in substantial savings in increased efficiency and fuel economy through the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.



Chicago Code Defines Engineering Work

EDWARD J. WOLFF, Consulting Engineer

IN 1947, the Chicago Association of Consulting Engineers appointed a committee to study Fees and Services of the consulting engineer. This committee found that Fees and Services varied as much as 300 percent, with the project studies and the extent of development of the consulting engineer's drawings being principally responsible for the big differential between the low and high extremes.

Survey Findings

Surveys revealed that some offices developed their plans and material lists to the point where the drawings could be used directly by the contractors for installing the systems. This type of service naturally commanded a good fee, but ultimately proved more economical for the owner. It produced keener competitive bidding, provided better control of the quality of the materials used on the project, and eliminated the need for preparing separate shop drawings. In many instances, the owner preferred this type of service because during the development of the drawings, some of the major components required in the various systems could be purchased directly.

In contrast, other offices offered drawings with only a minimum description of the various systems,

Edward J. Wolff received his BSEE degree from Armour Institute—now Illinois Institute of Technology. Following graduation, he was affiliated with Kelso-Burnett Company, Contractors, for 13 years.

In 1939, he became chief electrical engineer for Holabird & Root, Architects, Chicago, and continued in that capacity until 1948—except for a period from 1943 to 1945 when he served as a commissioned officer in the U. S. Navy and spent 15 months aboard the aircraft carrier, U.S.S. Essex. Since 1948, he has been in private practice as a consulting engineer. Mr. Wolff currently is President of the Chicago Association of Consulting Engineers.



details and quantities being covered in the specifications. Some even went to the extent of asking the installer to guarantee the results. Under these conditions, the contractor frequently had to re-engineer his part of the work and to make shop drawings from interpretation of the consultant's drawings and specifications. The specifications accompanying this type of service usually incorporated the so-called "murder clauses."

The Chicago Association of Consulting Engineers recognized that such disparity in engineering services was extremely detrimental to everyone con-

SUMMARIES OF TYPICAL MATERIAL IN CHICAGO'S "CODE OF TRADE PRACTICES"

It is intended that all drawings developed by Consulting Engineers and Architects should be complete in detail for general mechanical installation so that installation drawings will not have to be made by subcontractors. Manufacturer's detail drawings on special equipment will still be required. It is intended to eliminate the necessity of drawings being made by the installer. This should result in economy because of the duplication where the installer prepares installation drawings.

All drawings shall comply with current Laws, Codes, and Ordinances prevailing in the area of construction.

All Mechanical Trades plans shall be stamped with the Illinois State Registered Professional Engineer stamp.

Sectional drawings of congested areas shall be made to show all mechanical trades where interferences occur, for better coordination.

Scales of working drawings shall be 1/4, 1/8, or 1/16 inch to the foot.

Scale of any required detail drawings shall be not less than 1/4 inch per foot.

Symbols as approved and printed in pamphlet form are to be used on all drawings.

Size of drawings should be in multiples of 8-1/2 x 11 inches, and where practical, sheets should not exceed 28 x 40 inches. All drawings of any one set for the same project should be of uniform size.

Blue line drawings are recommended instead of blueprints, for economy and clarity.

On special, or uncommonly used equipment, manufacturer's name should be given as well as his address or that of the local representative.

Complete duct and pipe sizing of job shall be shown on plan.

Complete details, with cross section through fan rooms, including intakes, roof ventilators, and louvre dampers of all types shall be shown on plan.

When the job is complicated, there shall be provided separate drawings for plumbing and heating piping.

Isometric drawings shall be furnished showing any detail pipe connections.

Piping riser and ventilating diagrams of job shall be furnished showing ceiling heights on riser diagrams.

Show eccentric fittings or pipe sizes, before and after reduction in size, on steam mains and branches.

Proper space must be allocated for sewers, waste and vent stacks, and water lines.

Show separate water lines on drawings from service pipe for domestic, fire protection, and air conditioning use.

Ventilating plans, for the distribution, supply, and exhaust ducts, shall be drawn to scale dimensions. Line drawings should not be used.

Provide ventilation schedules where required by City Ordinances. Complete characteristics of all fans in the system shall be shown on plan.

Sizes, types, and capacities of all supply and exhaust diffusers and grilles, with installation height from floor, shall be shown on plan.

Component sections of control units shall be spaced so that sections may be serviced from both sides through access doors in the casing.

All sheets shall have a name plate indicating name, date, and revision schedule.

Include all mechanical material, equipment, appliances, and accessories in mechanical contract and specifications.

Coordination of mechanical trades is necessary on construction work and a proper fee should be paid for this service by the awarding agency on the project.

The electric wiring and steam, water, air, and drainage pipe to all ventilation equipment requiring same shall be shown on the ventilation plans, but definitely show that this work is to be done by the trades involved and included in drawings and/or specifications of the trades involved.

Electrical plans shall show all service and meter equipment, which shall be determined by negotiation with utility company, and same indicated in detail on plan.

Over-all sizes of power and light cabinets, size of service, and material equipment, shall be shown on the drawings.

Electrical plans shall show complete feeder diagram for both light and power, with all cabinets marked with loads and number of circuits.

Indicate on feeder schedule, size of all feeders and conduits and size of connection taps to power and light cabinets with schedule showing circuits used and for future use.

Details shall be added where feeders are located in congested areas.

Branch circuits shall show pipe and wire sizes together with circuit numbers to every outlet included on the plan.

Provide circuiting for control wiring specified; also show all control wiring for equipment furnished by others and included in electrical contract.

Detail the type of support and either the distance from floor or length of stem required for light fixtures.

All control wiring shall be shown on plans rather than be called for in the specifications.

nected with the construction industry—consultants, architects, contractors, and owners alike. As a result, we instigated a joint venture with the four mechanical trades of the City of Chicago to develop a written set of rules and regulations covering the preparation of engineering drawings. This effort ultimately produced a "Code of Trade Practices," which is actually a method of standardizing engineers' design drawings for the mechanical trades.

Objectives of Program

Brief summaries of some of the typical material covered by the "Code of Trade Practices" are listed in the accompanying table. It should be noted that each item was studied and evaluated carefully in an effort to serve the basic requirements of the construction industry and to realize certain fundamental objectives:

- ¶ Assure greater efficiency and economy.
- ¶ Safeguard the public interests.
- ¶ Provide better service to the owner.
- ¶ Clarify and streamline the responsibility and scope of work to be performed by the professional man in the construction industry.
- ¶ Eliminate duplication of effort and time, both for engineers and architects as well as for contractors.
- ¶ Create better understanding and coordination among consultants, architects, and contractors, and between these groups and the clients.

Cooperative Effort

In preparing this "Code of Trade Practices," the Chicago Association of Consulting Engineers received valuable assistance and cooperation from the four participating mechanical trades: Electrical Contractors Association of City of Chicago; Heating, Piping and Air Conditioning Contractors, Chicago Association; Plumbing Contractors Association of Chicago; and Ventilating and Air Conditioning Contractors Association of Chicago. Each of these four groups appointed its own committee, and several meetings were held between ourselves and the four trades groups collectively.

First, we set up standard symbols for mechanical and electrical use that were agreed upon and sponsored by all of the participating groups. These symbols were printed in two bulletins* that have been widely distributed throughout this area.

We then investigated the problem of degree of engineering service. It was found that each of the four trades groups wanted to be relieved of the responsibility of preparing separate shop drawings.

*Chicago Metropolitan Area Standards, Bulletin 1-54, *Graphical Symbols and Abbreviations for Electrical Wiring Drawings*, and Bulletin 2-54, *Graphical Symbols and Abbreviations for Mechanical Equipment Drawings*, Technical Advisory Committee, Mechanical Construction Industries of Greater Chicago, August, 1954. Copies of each bulletin are available at 20 cents per copy from Chicago Association of Consulting Engineers, 11 South LaSalle St., Chicago 3, Ill.

This, of course, created a serious problem in the offices of those consulting engineers whose services heretofore had covered only minimum development of engineering drawings. In the course of these various meetings, each of the four trades groups voiced their desires insofar as details on the drawings were concerned.

All groups agreed that complete details were necessary for the processing of construction work and that somebody had to work out these details. Finally, it was decided that inasmuch as the consulting engineer was designing the system, he was in a better position to complete the development of the various details. This additionally achieved the desired result of eliminating duplication on the part of the contractor or installer.

Expect Further Progress

Other problems also were investigated thoroughly before preparing the current draft of the "Code of Trade Practices." As every man who has served on association committees knows, many ideas are brought forth, but few are finally selected for inclusion. However, we have made a start, and we feel it has been to the advantage of our profession, the trades groups, and the public as well. We all realize continuing effort will be required as the problems are becoming more and more serious because of the complexity of the engineered trades and the changing conditions that prevail in today's construction market.

Looking to the future, the inclusion of complete material lists as a part of the development of drawings may be considered. This would eliminate the duplication of take-offs, and every bidder would have the opportunity to bid on the same quantities. Unsuccessful bidders would save time and money—a definite benefit since every contractor prorates his over-all estimating costs on the construction work that actually becomes business on his books.

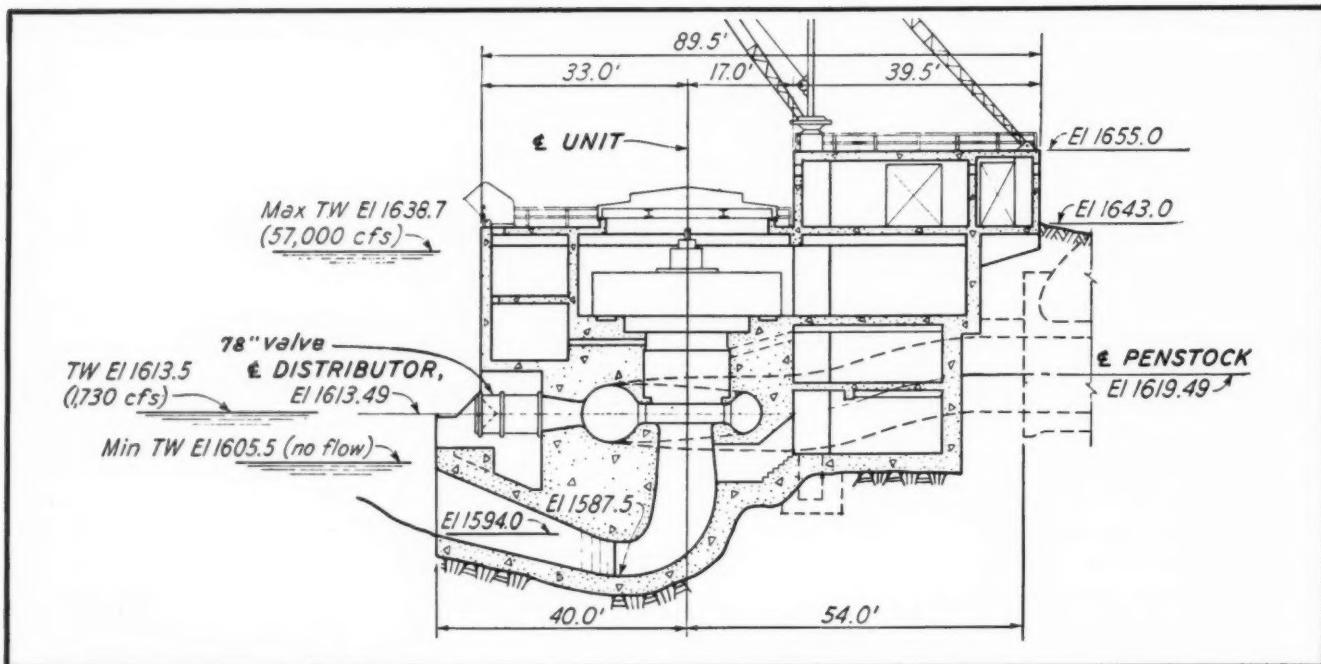
Striving for Recognition

Meanwhile, we also have recommended certain procedures to obtain recognition of our current efforts. One is the appointment of a Legislative Committee for the Mechanical Trades Industries to work with municipal agencies and the state legislature in the interest of economy, safety, and public health protection in the mechanical field. This would include clarification and interpretation of codes, laws, and ordinances. Another is directed toward better public relations through research and educational programs for the mechanical trades.

As all of these efforts continue, we hope to make substantial progress. In fact, just before the "Code of Trade Practices" was accepted, the Chicago Chapter of the A.I.A. appointed a committee to represent their group at meetings and to offer their opinions. Their cooperation will be helpful. ▲ ▲

TVA Installs Another Leffel Turbine

Nottely Dam Power Plant — a progress report as of the end of 1955



Completely assembled turbine except for riveted scroll case.

Powerhouse excavation and draft tube forms in place.



Assembled scroll case in position from above.

In the new hydroelectric power plant on the Nottely River near Murphy, North Carolina, the TVA is now completing the installation of another efficient Leffel turbine.

Nottely Dam, of the rock and rolled earth fill type, was completed in 1942, without a power unit. Installation of the No. 1 power unit was authorized in 1951 and a Leffel turbine was selected to drive the generator.

The turbine is rated to develop 21,000 HP under a net head of 124 feet at 180 RPM. The specific speed of the turbine at rating is 63.2 RPM. The operating head varies from 76 feet to 166 feet.

Other Leffel turbines installed by the Tennessee Valley Authority are located at Chatuge Dam in North Carolina and Wilbur Dam in Tennessee.

The efficient design and rugged construction of the Nottely unit—backed by 94 years' of experience in the hydraulic turbine field—make it typical of the notable hydraulic turbines built by Leffel for hydroelectric power projects throughout the world.

Leffel engineers are trained in design, construction and adaptation of the turbine which will most efficiently and economically meet the needs of each power plant development, whether it is a completely new installation or part of an expansion or rehabilitation program.

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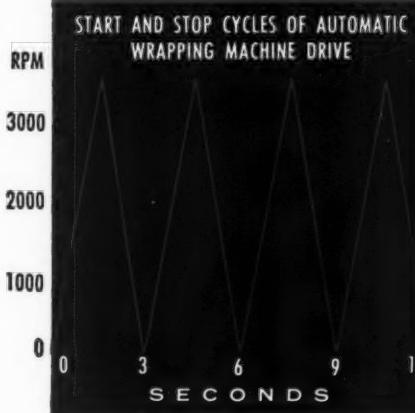
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REPORT FROM COPENHAGEN

FRITZ D. HIRSCHFELD
European Editor

A DANISH consulting engineer, Mr. Soren Rasmussen, in an article published in the local engineering journal, *Ingenioren* (13 November, 1954) has broken down the membership figures for the ten European National Associations of Consulting Engineers and compared the number of consultants with the total population to show the per capita relationship:

Country	Population	Member Consultants	Per Capita
Belgium	8,736,000	100	1:87,000
Denmark	4,281,000	130	1:33,000
England	50,772,000	340	1:49,000
Finland	4,033,000	25	1:169,000
France	42,600,000	800	1:53,000
Germany	48,600,000	474	1:103,000
Holland	10,264,000	61	1:168,000
Norway	3,169,000	107	1:29,500
Sweden	7,047,000	90	1:78,000
Switzerland	4,749,000	37	1:128,000

Next to Norway, Denmark has the greatest number of consulting engineer members in its Association in proportion to the total population. Two important conclusions can be drawn from these facts. First, a major portion of the engineering and construction projects in Denmark are done by consulting engineers who are members of the Danish Association of Consulting Engineers. And second, because of its broad membership base, the Association has won recognition and strong support in the community for its professional activities.

One direct result of having a strong Association is that the Danish engineers have been able to establish very realistic fee schedules. Instead of basing their fees on a sliding percentage of the total construction cost, they have carefully analyzed the different types of engineering projects and set up fee schedules to take into consideration the engineering responsibilities and experience factors that would apply to each category.

Engineering work, according to the Danish code, will fall under one or more of these headings:

- I. Erection of dwelling houses, factory and office buildings, storehouses, warehouses, sheds, halls . . .
- II. Reinforced concrete, steel, wood construction
- III. Supplying buildings with light, water, heat, ventilation, conduits, paving of yards . . .
- IV. Distribution systems for high and low voltage,

wireless stations, tramways, electric railways, and in-plant electric distribution systems.

V. Factory premises and layout of machinery, electricity, water, and gasworks.

VI. Individual sewage disposal systems.

VII. Roads and streets, sports stadiums, tramways and suburban lines.

VIII. Railways.

IX. Docks and harbors, dykes and barrages.

X. Ships, floating docks, floating cranes . . .

As an example, the fee schedule (taken from the Code of Practice for Consulting Engineers and published by the Institute of Danish Civil Engineers) for engineering docks and harbors, dykes and barrages (scale IX) is reproduced below:

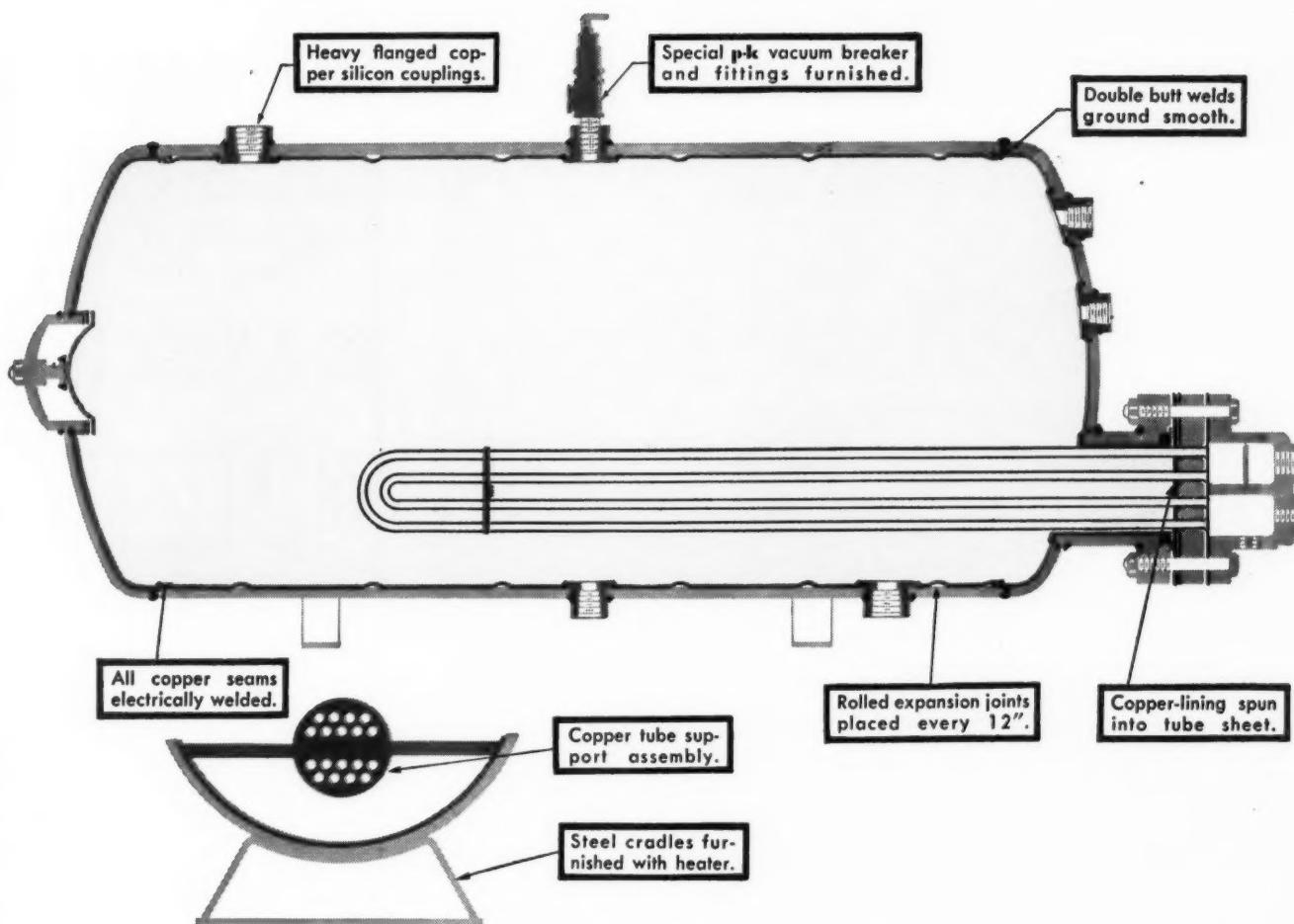
Cost of Works Danish kroner	Fixed Fee			Total
	(a)	(b)	(c)	
10,000	350	250	400	1000
20,000	610	460	730	1800
50,000	1270	1000	1630	3900
100,000	1870	1750	2880	6500
200,000	2970	2950	4980	10900
500,000	5370	5950	10680	22000

Danish kroner	Percentage of Additional Costs				Total %
	(a) %	(b) %	(c) %		
Of the First	10,000	3.5	2.5	4.0	10.0
Of the Next	10,000	2.6	2.1	3.3	8.0
Of the Next	30,000	2.2	1.8	3.0	7.0
Of the Next	50,000	1.2	1.5	2.5	5.2
Of the Next	100,000	1.1	1.2	2.1	4.4
Of the Next	300,000	0.8	1.0	1.9	3.7
Of the Remainder	0.8	0.9	1.8		3.5

The (a), (b), (c) headings refer to:

(a) General Planning — plans showing the provisional project, explanations of the main features of the project, estimates and calculation of the economic advantages in as much detail as may be necessary for the client to judge the proposition.

(b) Detailed Planning — putting the plan into correct engineering terminology, i.e., drawings with



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Some of p-k's experience is indicated in the diagram above. In the lining of this p-k heater, for instance, rolled joints are used at regular intervals around the full circumference, to allow for longitudinal expansion. Heavy flanged copper silicon couplings are securely welded to both the shell and the lining.

Standard equipment includes a special

p-k vacuum breaker to protect the lining from sudden pressure fluctuation.

Another very important point is the testing of all p-k copper-lined heaters to insure long trouble-free service. Separate hydrostatic and pneumatic tests are made to guarantee leak-proof linings.

Experienced engineers know these points are critical. They know, too, that there is no substitute for this painstaking p-k type of construction... and that insisting on and specifying these construction points in copper-lined heaters justifies itself over and over again.

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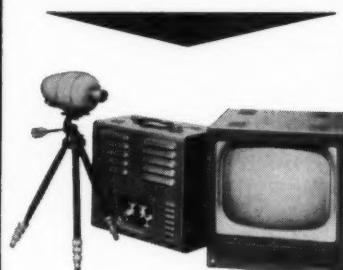
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transmission of visual
information

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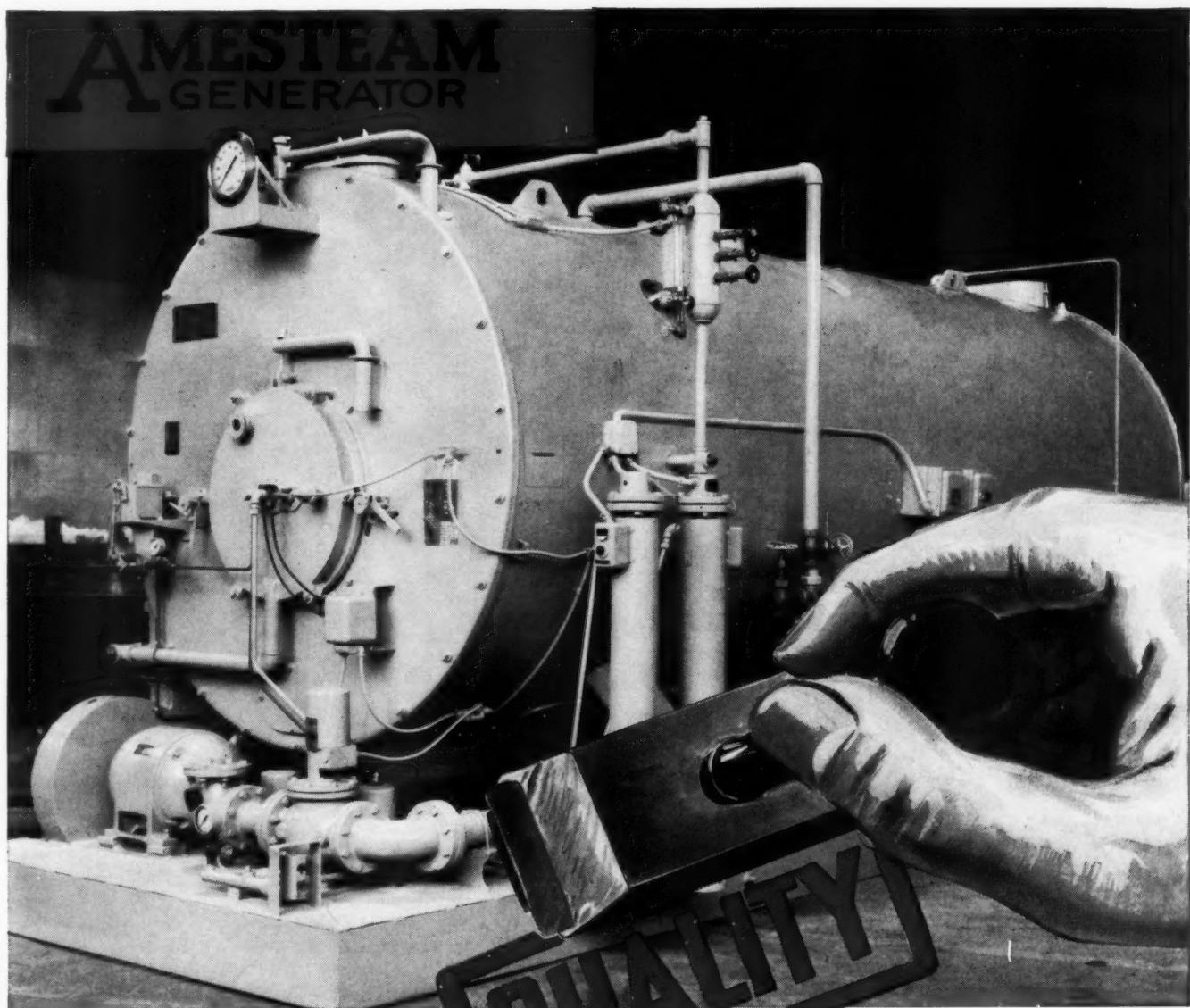
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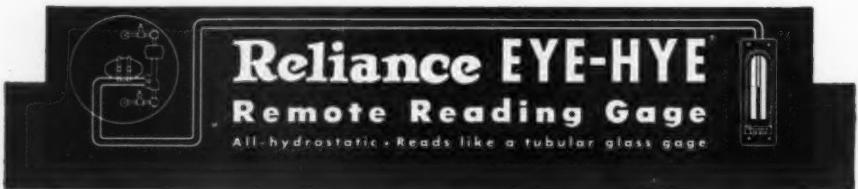


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the necessary measurements and information, together with the appropriate description, estimate, and specification of the work so that it may form the basis for operations. This includes any additional construction drawings.

(c) Site Administration — drawings, prospectuses and terms to be observed in making up tenders and executing the work, inviting tenders, examination of tenders received. Drawing up of contracts, supervising the construction of the work and providing the necessary supplementary drawings (though not working drawings), testing and examination of the completed construction, checking bills and presentation of accounts to the client.

To show how these fee schedules are applied, a sample project has been worked out:

The consulting engineer's assignment is a harbor pier in connection with the extension of an existing sewage disposal system and the construction of a warehouse of reinforced concrete.

Cost of work:

Harbor pier	kr. 490,000.-
Extension of sewage	
disposal	kr. 40,000.-
Warehouse	kr. 60,000.-
Total	kr. 590,000.-

The engineer is responsible for the planning and administration of the entire product. The fee is then calculated from scale IX (docks and harbors, dykes and barrages).

General plan. Entire cost of works: 590,000 kr.

Scale IX, column (a)
Fixed fee for first 500,000 kr. .kr. 5,370.-
0.8% of the following 90,000 kr.

kr. 720.-
kr. 6,090.-

Detailed plan and site administration and supervising the work.

1. Harbor pier. Cost of construction: 490,000 kr.

Scale IX, columns (b) and (c).

Of the first 200,000 kr.:
2,950 + 4,980 kr. 7,930.-
1.0% + 1.9% of the following 290,000 kr. kr. 8,410.-
kr. 16,340.-

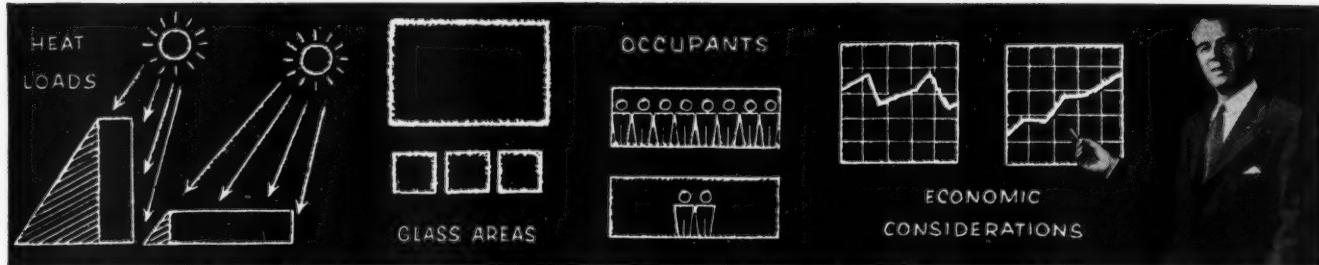
2. Extension of sewage system.

Cost of construction: 40,000 kr.
Scale VI (not shown), column (b) and (c).

Of the first 20,000 kr.:
580 + 660 kr. 1,240.-
2.5% + 2.8% of the following 20,000 kr. kr. 1,060.-
kr. 2,300.-

3. Warehouse. Cost of construction:

60,000 kr.
Scale II (not shown), columns (b) and (c).



Heat loads and glass areas and number of occupants and floor areas, economic considerations and taxes and depreciation and operating costs—all these factors (and still others) influence the choice of an air conditioning system for a large building. And since these factors vary from building to building, obviously no one system—or even two or three—can answer each building's needs best. That's why York carefully selects and then precision-engineers each Yorkaire System to fit its particular building.

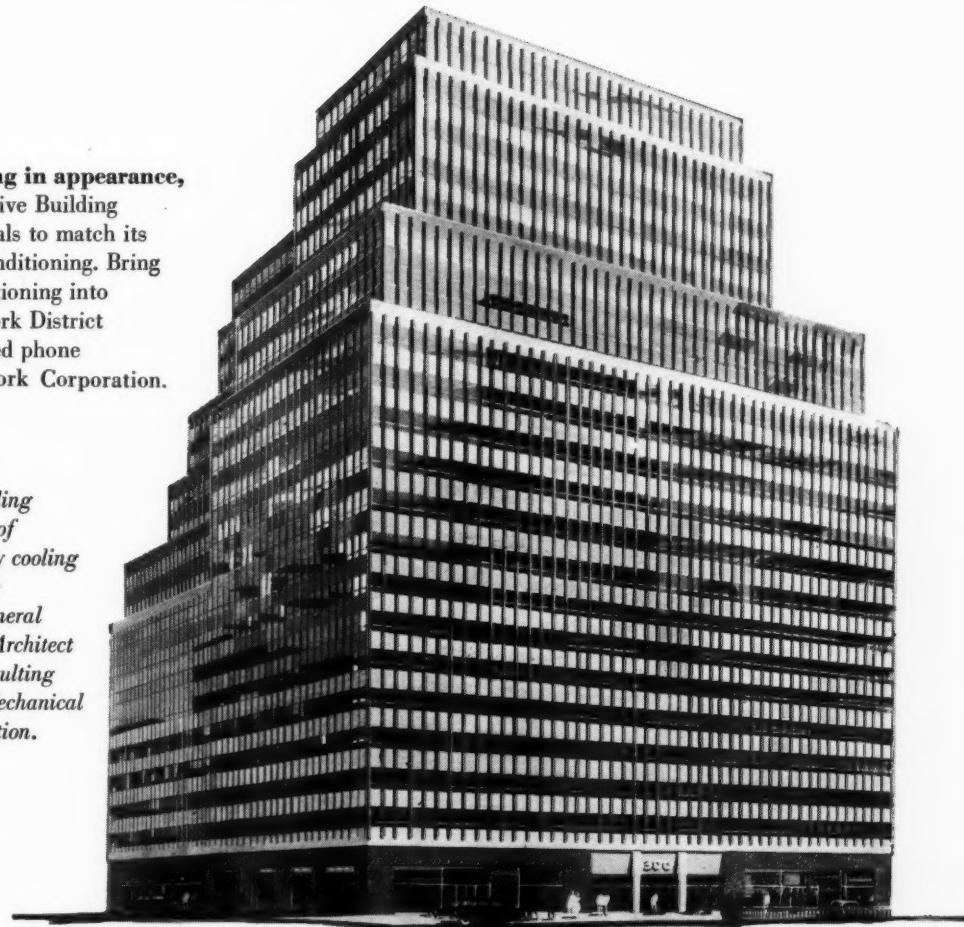
This ability to meet each building's exacting specifications, to bring the *right kind* of air conditioning to any building, old or new—and to do it all at a reasonable price—appeals so strongly to our first-time customers that they call it a "new concept" of air conditioning. York's method is possible, not only because York Engineers have a great variety of quality Yorkaire Systems from which to select, but also because these men are highly skilled professionals in the science of air conditioning.

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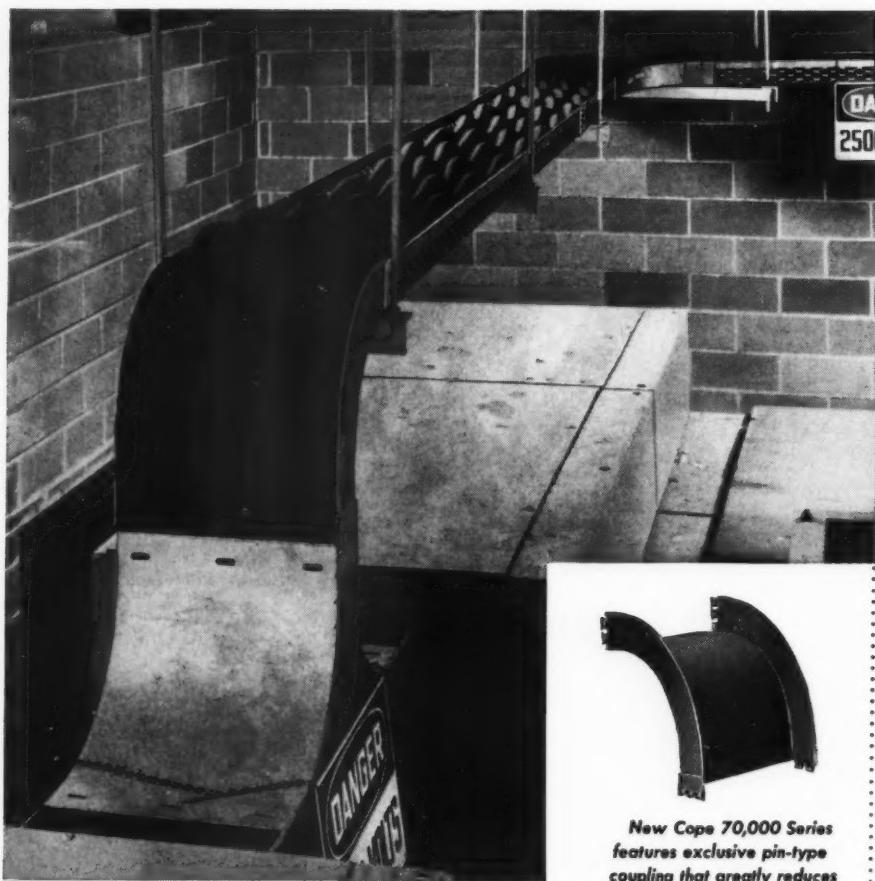
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Grand total fee kr. 28,370.-
(There are approximately 7 Danish kronor in one U.S. dollar.)

Where a dispute may arise between the consulting engineer and the client regarding the interpretation of these fee schedules, the point at issue will be decided by a court of arbitration set up by the Institute of Danish Civil Engineers, itself.

The "Code of Practices" is also explicit about the relationship between the client and the consultant. "The engineer is paid by the client and by the client alone. The engineer must, therefore, neither receive nor demand any kind of commission, rebate, or the like from the contractor or the supplier, in favor of anyone but his client; if the engineer's relations with the contractor or the supplier are such that any doubt may arise as to his fitness to watch over his client's interests in a thoroughly impartial manner, he must fully inform his client about this beforehand." The penalty for the violation of this principle is forced resignation from the Association. And because membership in the Association is highly regarded in Denmark, a non-member would find his business severely hurt by such a move.

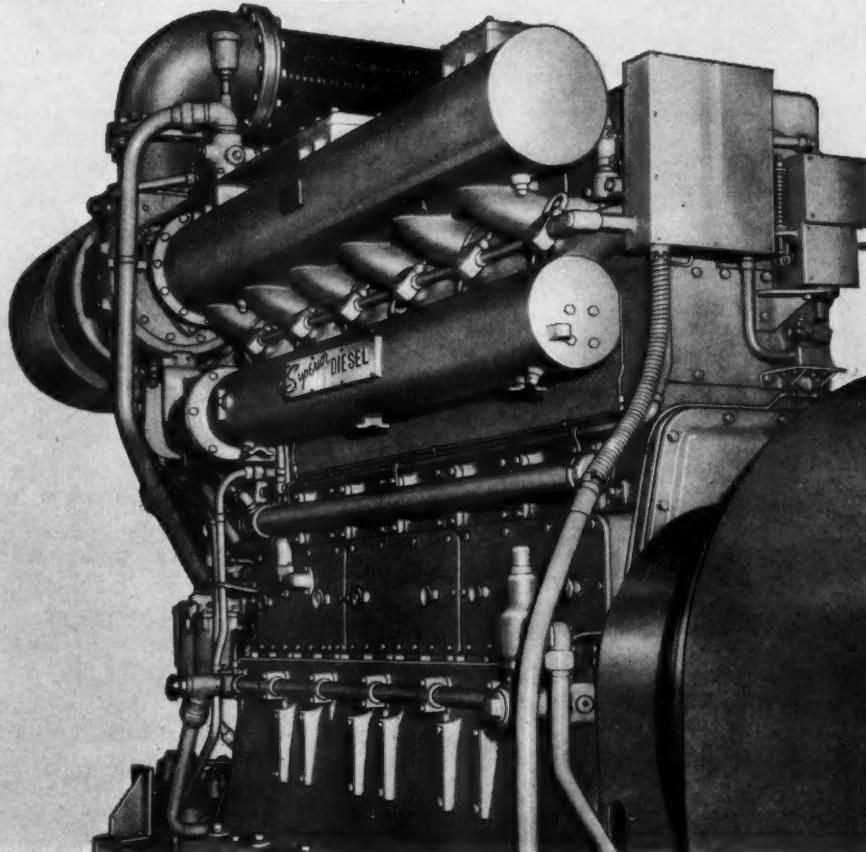
Of Denmark's 130 member consulting engineers, about 70 center their activities in Copenhagen. The remainder make their living in their own local communities. A number of the Copenhagen consultants are busy on the international scene. Steensen & Varming are civil engineers who have recently opened an office in Dublin to take advantage of the growing trend towards industrialization in Southern Ireland. At home, Steensen & Varming are particularly proud of their design of the new Institute for Nuclear Research, in Copenhagen.

Ostenfeld & Jonsson have been pioneers in the use of pre-stressed concrete in a wide range of structural applications. They have an outstanding reputation throughout Scandinavia for their ability to

see how

Superior or Atlas Engines

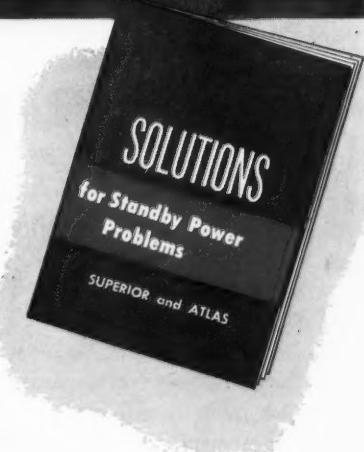
solve your standby power problems



Model 40 Superior
Engine-Generator Set,
an engineered instal-
lation, solves standby
power problems of an
Ohio company.

Engineered installations of Superior and Atlas Diesel, dual fuel and gas engine-generator sets have solved hundreds of standby power problems! In many cases they've paid for themselves. Their automatic start and stop operation often averts tragic consequences, by providing efficient, dependable power for essential plant services in every instance of main power source failures. In order for you to have all the facts and figures we've prepared a special case history file. It shows many instances of how our skilled engineers assisted in solving serious problems involving special considerations and peculiarities in individual installations. Chances are many of the installations will be similar to yours. This information will prove a valuable aid in your planning.

Write, on your letterhead, requesting this file of helpful examples. White's skilled engineers, with years of experience in developing engineered installations of Superior or Atlas engine-generator sets, will assist you in engineering the proper standby power for your specific requirements.



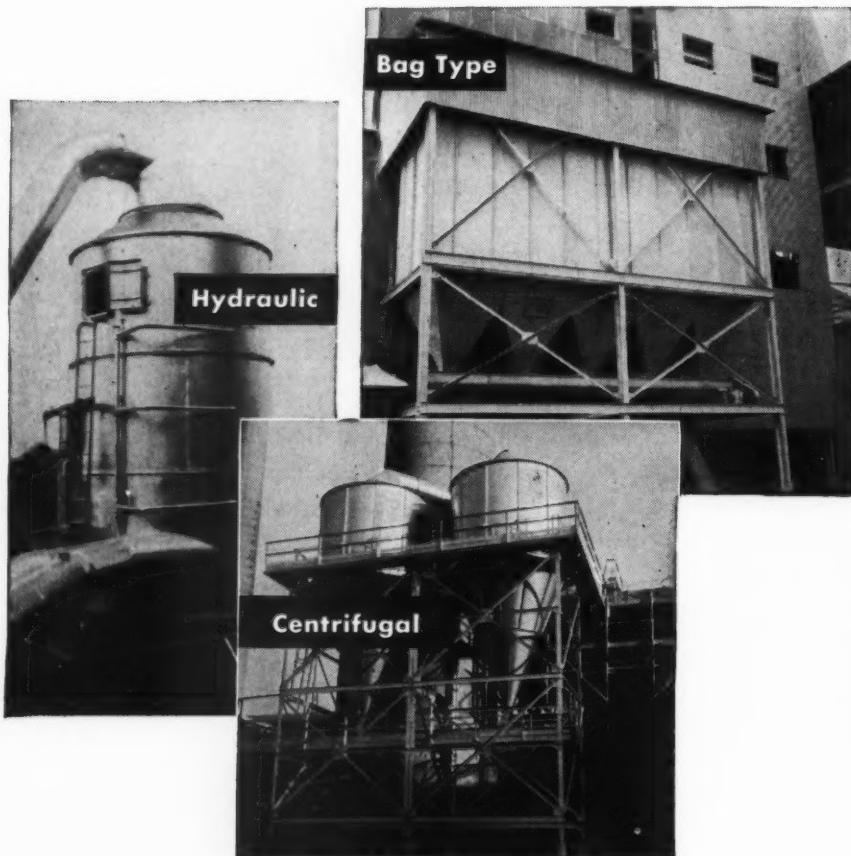
WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY • Plant and General Offices: Springfield, Ohio



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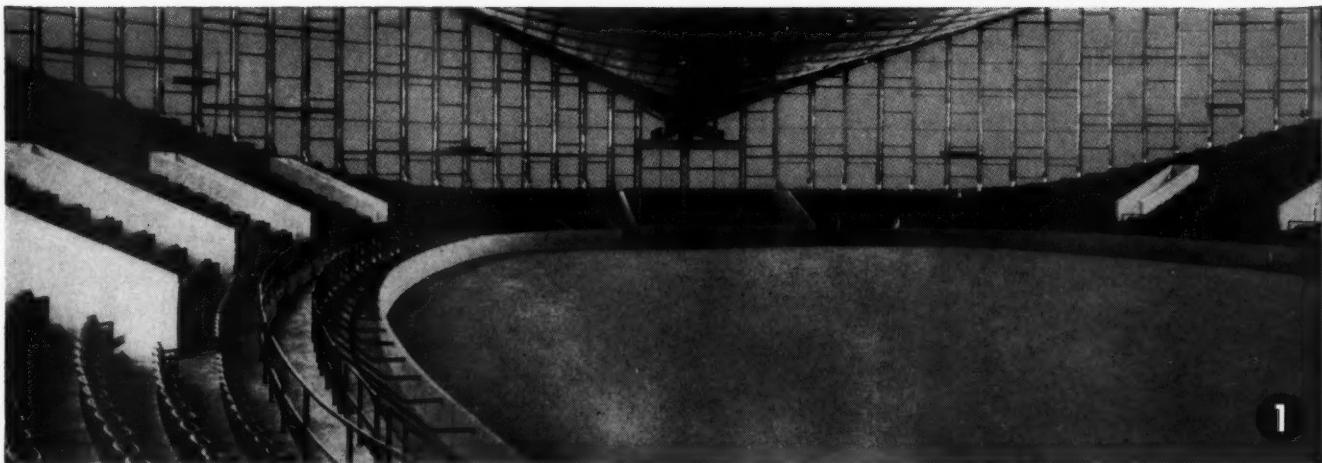
There are in Copenhagen two large international contractors, Cristiani & Nielsen and Kampsax. These firms are not members of the Danish Association of Consulting Engineers — although Kampsax does only consulting work in Denmark, he is barred from membership because he engages in contracting as well as consulting engineering in his foreign assignments.

I visited with Mr. Saxild, the senior partner of Kampsax, while in Copenhagen. Mr. Saxild and Mr. Kampmann started in Turkey, in 1927, designing and constructing the railway system for the Turkish government. Between 1927-37, the firm built about 1,000 kilometers of track, bridges, and tunnels worth over \$50 million.

During the war, Kampsax built the Trans-Iranian railway—800 miles long at a cost of 30 million English pounds. The railway was finished in time for the Russians to receive badly needed supplies when they were defending Stalingrad against the Nazis. Kampsax also built roads, airfields, barracks for the British in several countries in the Middle East.

Late in the 1940's Kampsax started four big harbor projects—breakwaters, keys, sheds, dredging—for the Turks. Recently added to this work was \$10 million of dock facilities in Istanbul. In Syria, Kampsax is responsible for developing the port of Latakia at an estimated cost of \$50 million. And two harbor projects were just started for the Iranian government along the Persian Gulf worth in the neighborhood of \$20 million.

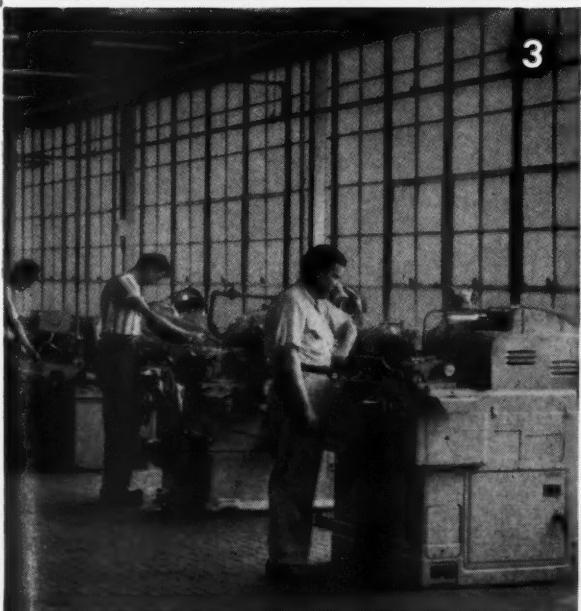
Mr. Saxild, in his conversation with me, expressed a desire to cooperate with American consulting engineers on work in the Middle East. His many years of experience in that area, outstanding reputation, and perhaps the fact that Denmark is in no way involved in the political turmoils there, are valuable assets. Mr. Saxild, as other European consultants, offers American engineers many interesting possibilities for cooperation.



1



2



3

3 PROBLEMS OF SUN HEAT AND GLARE...

SOLVED WITH AKLO® GLASS

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2. Working areas close to windows
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Aklo Heat Absorbing Glass lets you have an abundance of daylight without the penalties of sun heat and glare. That's why it is ideal for eye comfort, for bodily comfort . . . in all kinds of buildings. Rooms not only look cooler with daylight filtered through this blue-green glass . . . they *are* cooler. *Aklo* Glass in $\frac{1}{4}$ " thickness shuts out as much as 44% of the sun's radiant heat energy.

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PHONE FOR THIS TEST. The Blue Ridge radiometer demonstration kit will show you how Frosted *Aklo* Glass reduces glare and sun heat. Call your L-O-F Glass Distributor or Dealer listed under "Glass" in the yellow pages of your phone book. Or write to Libbey-Owens-Ford Glass Co., 608 Madison Avenue, Toledo 3, Ohio.



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air-cooled transformers or substations

electric distribution systems
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The most practical type transformers to step down voltages at load centers are SORGEL air-cooled dry-type transformers. They can be installed in almost any convenient place inside of buildings, without fire-proof vaults or other enclosures. SORGEL transformers are of the highest quality, and require little or no maintenance. No liquid to check nor replenish; small and compact; easy and convenient to install; economical operation.

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Complete Line

1/4 Kva to 2500 Kva, single phase.

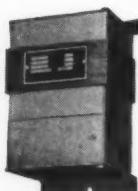
1 Kva to 3000 Kva, 3-phase, 2-phase and phase changing.

All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, up to 15,000 volts, and any intermediate or special lower voltages.

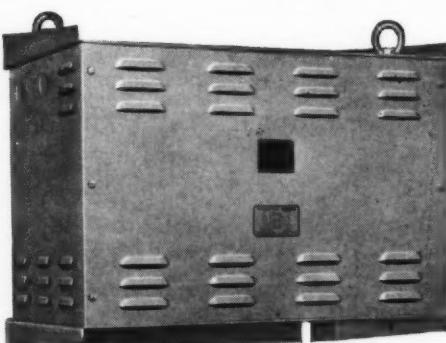
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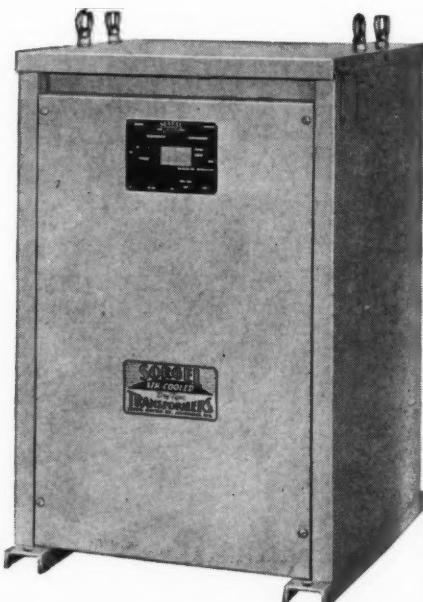


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single phase
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15 to 50 Kva 3-phase. Wall mounting type

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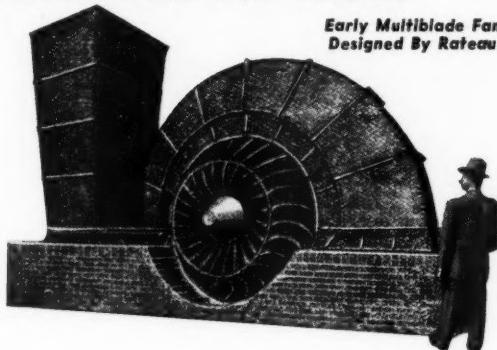
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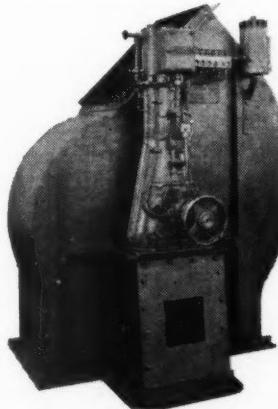
EVOLUTION OF CENTRIFUGAL FAN DESIGN



Early Multiblade Fan
Designed By Rateau

THE French engineer, Camille Rateau (1863-1930) designed his forerunner of multiblade centrifugal fans on the basis of theories borrowed from experience with turbines and other centrifugal devices. Intricate castings and forgings, weak and brittle materials, slow and cumbersome prime movers, massive masonry and wood structures, were the rule.

Today's centrifugal fan evolved from theory based on specialization in fan design and usage. Modern fabricating and welding techniques, materials and components, high-speed prime movers, streamlined concrete and steel structures are now available. These refined tools can provide centrifugal fan designs adapted to modern needs, when combined with skill that is born of experience.



Early Model,
BAYLEY Forward
Curve Steam
Driven Fan

No. 1 of a Series of
"Fan-a-Grafics." Ask
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Cutter to trim out com-
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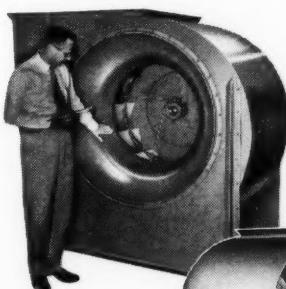
A CENTURY OF MANUFACTURING . . .

BAYLEY, founded one hundred years ago, a pioneer in iron fabrication, machine building, and foundry work, became familiar with basic principles and practical application of heating and ventilating equipment as early as 1885.

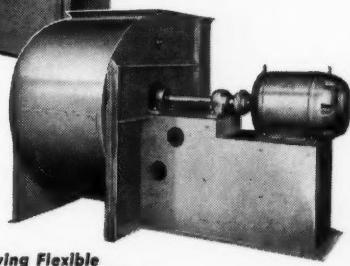
This broad knowledge and background has been essential to the development and application of all types of centrifugal fans—for industrial exhaust, materials handling, high velocity air-conditioning. Bayley engineers have used basic research to convert this experience into modern designs involving various wheel styles, proportions, sizes, and arrangements.

WHAT YOUR MODERN-DAY FAN PROVIDES . . .

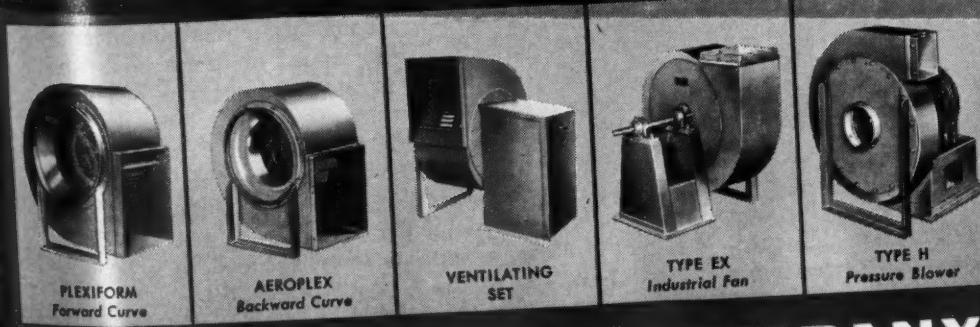
The 1956 Bayley Fan embodies the most effective use of materials and methods, achieving maximum strength-weight ratio. Structural problems are simplified. Clean design minimizes breakdown hazards. Designs are flexible—readily adapted to specific applications. Result—SYSTEM-MATCHED designs providing maximum efficiency and economy throughout the completed installation.



Modern Bayley 445
Aeroplex Fan



Showing Flexible
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AIR HANDLING
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NEWS

Briefs of current interest to the consulting profession plus notes on new equipment in the field of engineering

Oklahoma and Arizona Study Industrial Resources

Looking ahead to the advantages of further industrialization as the Nation's population moves westward, the Oklahoma legislature created an Oklahoma State Department of Industry early in 1955. The department recently retained Fantus Area Research, Inc., of New York, to conduct an industrial study of the state's resources at a cost of \$50,000. Funds for the study will be paid out of the legislative appropriation for the new department.

The study will be designed to present an impartial evaluation of cost factors and locational needs, industry by industry, to determine the state's ability to match specific technical requirements. It will include a breakdown of market potential, raw material accessibility, and distribution of operating costs for more than 100 major industrial categories.

Said to be the first study of its kind to be conducted for a state industrial development agency, it will be used as a selling tool by the department and other promotion groups within the state.

Arizona, looking into the feasibility of attracting new industries, had retained Stanford Research Institute to make a detailed study of the impact of industrialization upon the state's finances. The study was divided into three parts: public revenues from the plant and satellites; public revenues from the payrolls of the plant and satellites; and public expenditures attributable to plant and employees.

The final report, now before the state legislature, recommends that the state tax on sales to the Federal government be discontinued as a detriment to economic development, and forecasts that Arizona-located plants selling to the Federal government would more than pay their own way.

New Instruments Speed Research on Smog

Founded only a year and a half ago, the Air Pollution Foundation recently made public nine special research tools it has been instrumental in developing or adapting for use in air chemistry. All automatic and continuously operating, the instruments

are expected to speed research in the cause and eventual cure of smog.

Probably the most important instrument is a device conceived by Dr. Lewis H. Rogers, Foundation chemist, which measures and records the concentration of four pollutions over a 24-hr period—oxidant, oxidant precursor, nitric oxide, and nitrogen dioxide. Amounts of these pollutants are recorded on a single roll of graph paper, allowing researchers to make side-by-side comparisons.

Three separate instruments developed during the last year are combined in Dr. Rogers' control cabinet. One of these, the oxidant recorder, was used by the Foundation in its 1955 aerometric survey of the Los Angeles Basin. The nature and origin of oxidants are important since high concentrations are accompanied by reduced visibility, eye irritation, and crop damage.

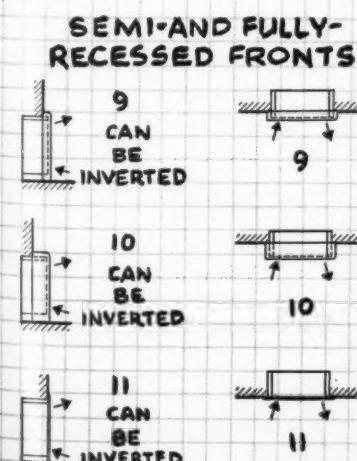
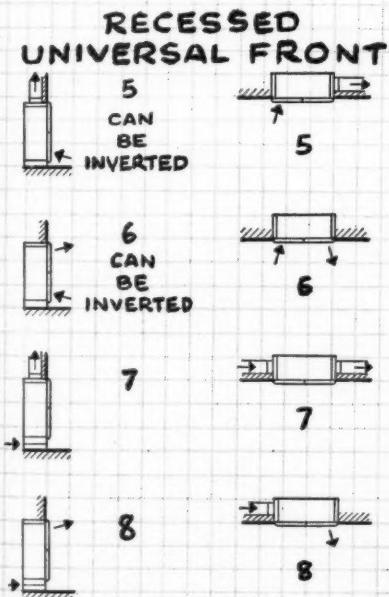
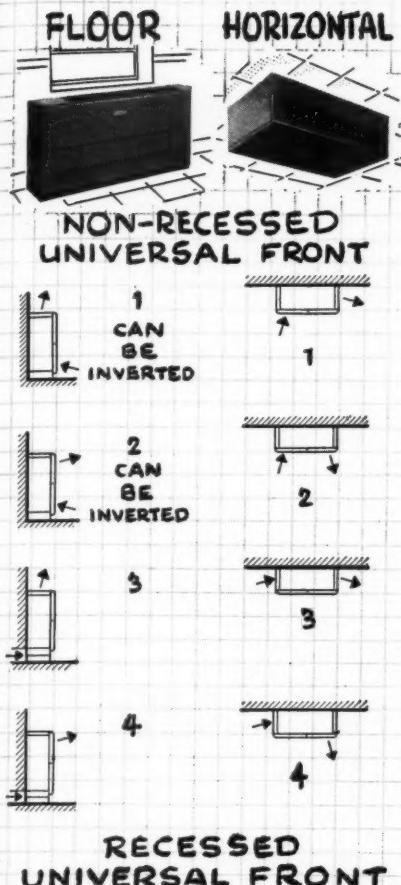
The second device is a Foundation developed model of a precursor oxidant recorder conceived by Dr. Fred Littman, Stanford Research Institute chemist, for use with the oxidant recorder. It takes continuous samples of the atmosphere during the night, subjects part of the samples to irradiation by artificial sunlight, and records the oxidant in the non-irradiated and irradiated samples. This instrument has established that smog-free night air can be converted into smoggy air by artificial sunlight.

The third device is a nitric oxide and nitrogen dioxide recorder utilizing a chemical method for measuring NO₂, reported a year ago by Dr. Bernard Saltzman. The instrument has made possible the first automatic and continuous measurements of nitrogen dioxide and nitric oxide in the air. Nitrogen dioxide is a trigger for smog forming reactions and originates primarily from nitric oxide formed during combustion.

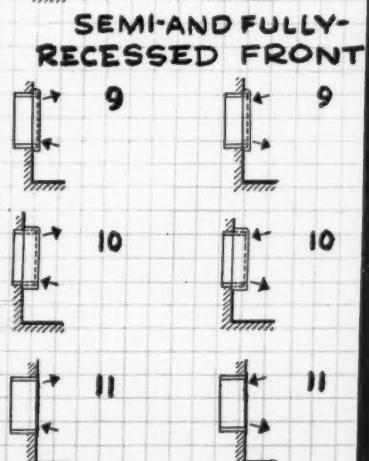
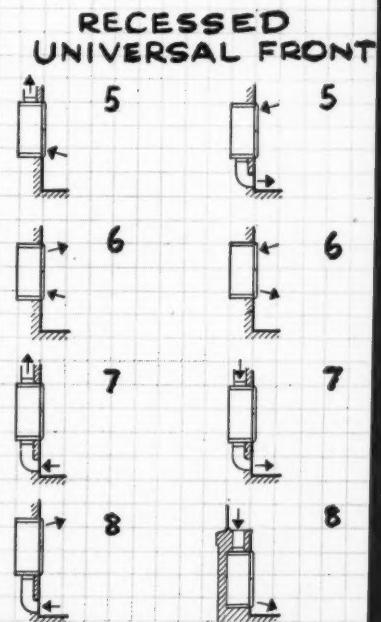
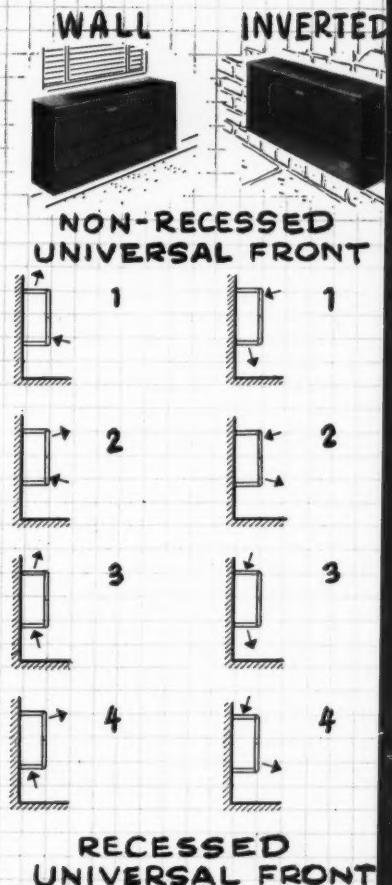
Among the other instruments in use by the Foundation is an ozone radiometer, a photoelectric device that measures the amount of ozone in the air, the gas suspected of being a major cause of rubber cracking, paint deterioration, and plant damage; and a carbon monoxide recorder that makes it possible to tell from unusually high concentration of carbon monoxide in the air whether or not pollution is from motor vehicles.

Foundation scientists have succeeded in building a laboratory model of a hydrocarbon recorder and

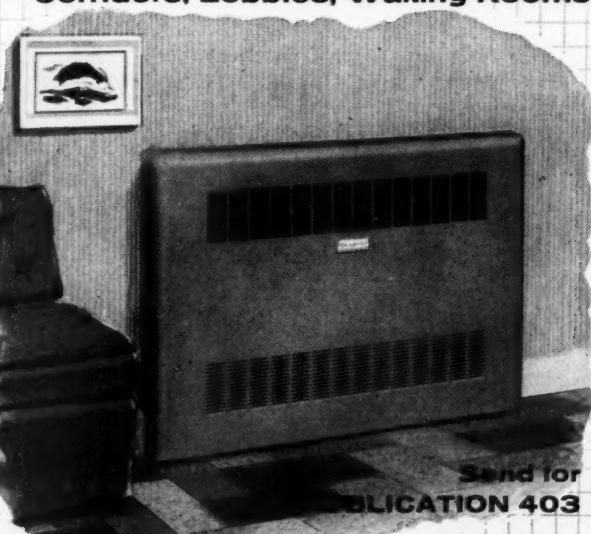
A System Designer's DREAM



5 unit sizes
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Each available in a wide variety of fan speeds and heating capacities for steam or hot water.



JOHN J. NESBITT, INC., PHILADELPHIA 36, PENNSYLVANIA

are now working to produce such an instrument at a reasonable cost. A photoelectronic aerosol particle counter—built to segregate tiny visibility-clouding particles in the atmosphere into 20 separate size groups—is undergoing calibration tests at UCLA. It is based on a prototype designed and constructed by Professor Chester T. O'Konski and George J. Doyle, of the University of California at Berkeley. This device is expected to show how big a part auto exhaust plays in reducing visibility.

The ninth instrument is an aero-meteorograph that can be attached to small captive balloons to probe the atmosphere at various levels for readings on temperature, air pressure, and relative humidity. Its prototype was designed by Don T. Hilleary, research assistant in the Department of Meteorology at UCLA, for Air Force study of the inversion layer.

With these advances in research tools what are the prospects of solving the smog problem? Improved, but still sometime in the future, according to the Air Pollution Foundation.

New Electronic Equipment Installed in New York Bank

The closed circuit television installed two years ago at the first branch office of the New York Savings Bank has proved so successful that the bank has included plans for increased use of television and pos-

sibly its own micro-wave network at its new and larger Radio City office.

Original estimates of the amount of deposits that could be handled at the first office with its 1500 sq ft were \$50 million. The branch office actually handled up to \$75 million without increasing equipment or personnel. The new branch office, with its 4000 sq ft, is expected to accommodate deposits of \$250 million, with only a 25 percent increase in equipment and personnel.

The use of the closed circuit television not only makes it possible to increase banking hours, but offers better teller service at the branch office since the teller never has to leave her post.

A General Precision Laboratory television camera is located in the accounting room of the bank's main office at 14th Street and 8th Avenue. The ten tellers at the branch office each have monitors mounted in their desks. The teller flicks a switch and is connected to the central accounting room 2½ miles away. She asks for the desired information, the record clerk puts the proper record card under the camera lens, and the picture is received on the monitor.

If the bank opens another branch office, it will consider setting up its own micro-wave network, with television transmission between the main office and its branches. The present system uses telephone company lines for transmission.

To operate in conjunction with the TV, New York Savings has installed National Cash Register elec-

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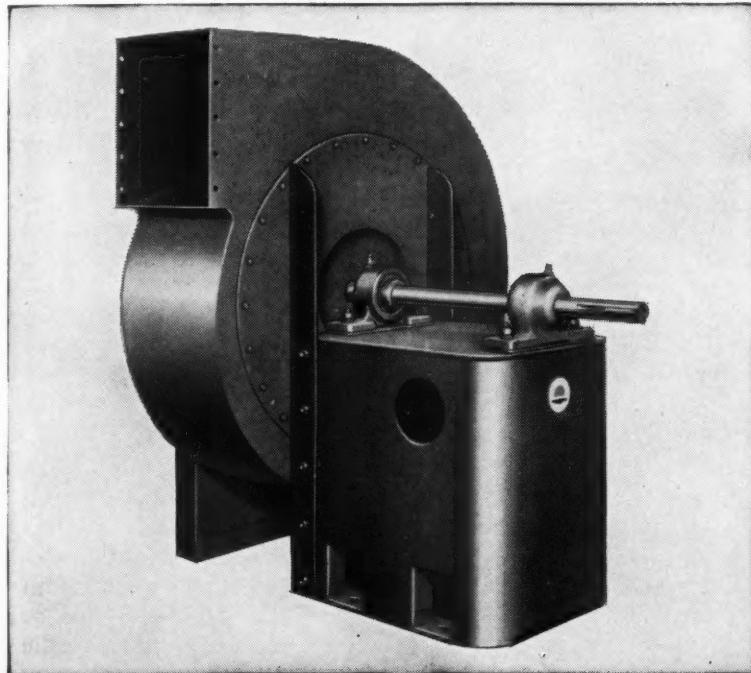
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Series 106 Industrial Fan



Certified ratings! Pressures to 18" w.g.! Volumes to 125,000 cfm! Heavy construction! Choice of 3 special-duty wheels! You get all these features, and many more in American Blower's new Series 106 Industrial Fans.

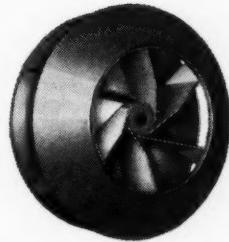
Available in 16 sizes, each with a high efficiency rating. Series 106 fans offer a wide range of optional accessories and construction features to meet standard or special specifications — or you can buy it in 7 sizes as an efficient, heavy-duty "packaged" industrial fan, complete with motor, V-belt drive and weathertight running-gear enclosure.

Get complete data from your nearest American Blower Branch Office, or write for Bulletin 5306-H.

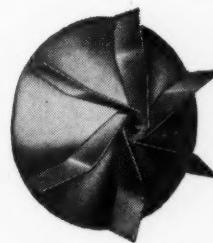
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Air Handling — for efficient handling of air, fumes, or gases — either clean, or containing light concentrations of dust or materials.



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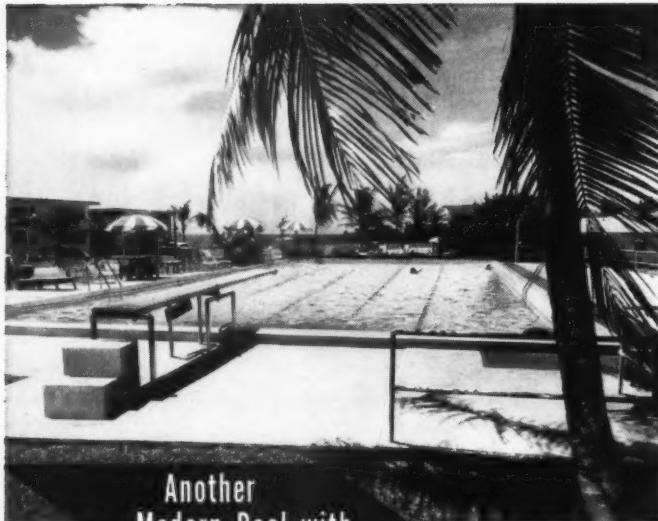
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Another
Modern Pool with
ADAMS SPF
FILTERS

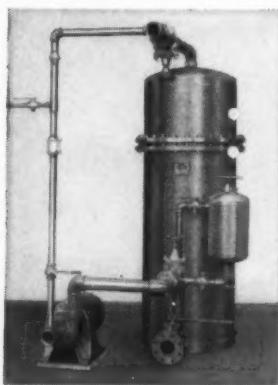
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Silver Thatch
Inn, on Pom-
pano Beach, Flor-
ida, offers its guests
this lovely pool with un-
derwater picture windows.

YES, here's another distinctive pool with the popular Adams Poro-Stone filters. More and more public pools are insisting on Adams Filters, and there are many good reasons why. Here are two of the important ones.

First, the exclusive ADAMS HI-FLOW backwash design gives you simple and easy cleaning . . . no messy disassembly . . . no scrubbing of filter elements. The high air dome and unrestricted backwash outlet provide complete purging of the filter tubes with high velocity water.

Second, rugged 4½" O.D. PORO-STONE elements with nearly 40% open area are unaffected by corrosion. The first Adams swimming pool filter — in use since 1938 — was the first Poro-Stone Swimming Pool Filter installed in this country.

There are numerous other reasons why it pays to specify and buy Adams SPF filters. Get all the facts by writing for your copy of Bulletin 625. Use the Handy coupon below.



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**R. P. ADAMS
CO., INC.**
256 East Park Drive
Buffalo 17, N.Y.
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This Adams SPF-129 Poro-Stone Filter keeps the Silver Thatch Inn pool water brilliantly polished for the enjoyment of swimmers and viewers alike. It offers 129 square feet of filter area . . . will handle pools up to 185,000 gallons capacity. It is ideally suited for outdoor pools such as shown above.

R. P. ADAMS COMPANY, INC.
256 EAST PARK DRIVE, BUFFALO 17, N.Y.

F-56

Please send me by return mail your new Bulletin 625.

Name..... Title.....
Business.....
Street.....
City..... State.....
Size of pool is..... gallons.

tronic accounting machinery that handles deposits, withdrawals, checks, money orders, and Christmas Club on the same machine. The next addition will be an automatic recording machine that will simultaneously punch each transaction on a tape, which in turn can be used to reproduce an IBM record card.

Weld Inspection Sure and Inexpensive With Radioactive Cobalt

Cobalt-60 is being used successfully and economically to test welds in piping, valves, and large and complicated alloy steel castings in which walls as thick as 2½ in. are built-up by welding at the Toledo, Ohio, plant of The National Supply Co.

Use of cobalt-60, which is obtained from the Atomic Energy Commission through Tracerlab, Inc. gives the company a source of gamma rays equivalent to that of radium costing more than 30 times as much. Although cobalt-60 loses half of its energy in 5.3 years, whereas it takes radium 4000 years, the cobalt-60 can be replaced several times at a small fraction of the initial cost of radium.

To prepare for gamma-ray inspection, X-ray film is wrapped around the outside of a weld and metal numbers taped at several points for identification of film position and location of defects, if any. Penetrometers consisting of small pieces of steel about 2 percent of the metal thickness and with two or three holes through them are also taped on the metal near the welds as a means for comparing possible dark spots that indicate defects. The film is covered with opaque paper as protection against visible light rays. The cobalt-60 is then put in position to emit its gamma rays through the weld. It is left in this position for periods ranging from 20 minutes to 8 hours.

Exposure time depends upon four factors: the strength of the radioactive material (depending upon the time it has been in use), the thickness and density of the material to be tested, the distance between the cobalt-60 and the film, and the type of film. The time is computed before each test.

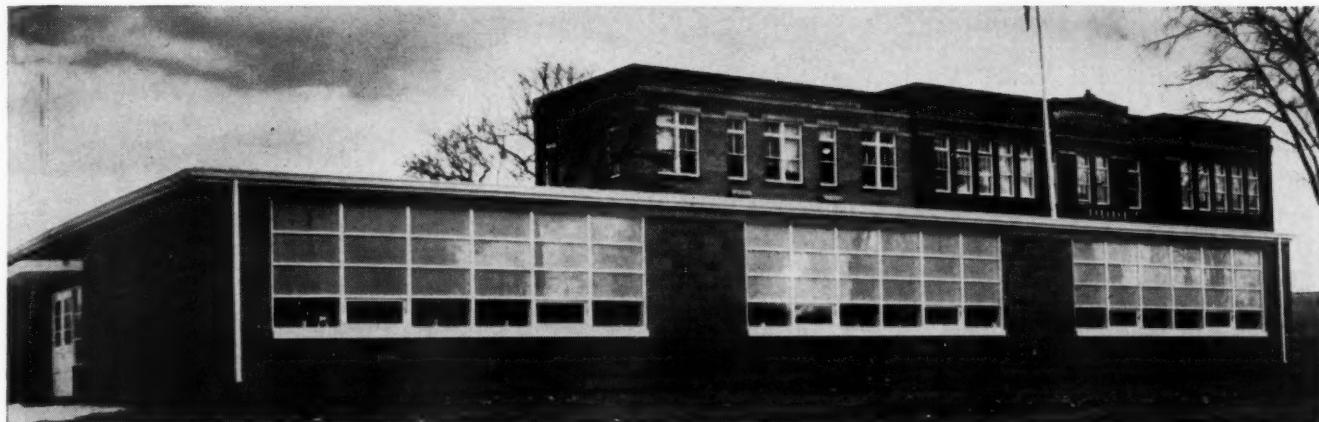
The company, whose metallurgists have been making nearly 30 gamma-ray inspections a week, has found the method more satisfactory than either the shipment of these large parts to a commercial laboratory for inspection, or the utilization of the services of such a laboratory when the testing equipment is brought into the plant.

It's Neither Too Hot Nor Too Cold

Heating facilities for the new \$3 million Student Activities Building of the University of Maryland have been designed to warm the spectators rather than the building.

A radiant heating installation was tailored to the specific shape, size, and purpose of the building by

GILSULATE® helps Wisconsin School build 5 modern classrooms for less than \$55,000



Cadott School

"The installation of this material is so simple that it is almost unbelievable."

E. F. Klingler & Assoc., Eau Claire, Wisc.

Considering that most modern schoolroom construction costs average well over \$30,000 per classroom, the low cost of the Cadott School is outstanding.

Several unique design features were incorporated in the building—among them, running steam and return mains about 6" outside the foundation lines of the building,

eliminating costly crawl space or pipe tunnel construction.

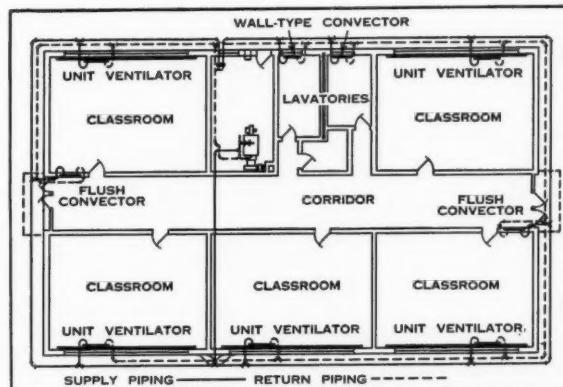
For pipe insulation, E. F. Klingler & Associates chose GILSULATE. The pipes were covered with GILSULATE to a thickness of four inches on all sides, and backfilled. At the highest point in the lines, there are six inches of fill over the insulation and at the low point, about two

feet. GILSULATE is so effective that at no time during the winter did the snow melt above the pipes—or even thaw the earth.

No other method for insulating and protecting hot underground pipes can match Triple-Zone GILSULATE for low cost of installation, efficiency and permanence. Fill in coupon below for complete details.

FACTS ABOUT GILSULATE

1. **EASY TO USE**—just pour and tamp...pipe heat does the rest.
2. **FORMS 3 ZONES** of protection against heat loss and all hazards commonly encountered by hot buried pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS**: no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING**: for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE**:
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Type B for 300°-385° F. temp. range
Type C for 385°-520° F. temp. range



Cadott School
floor plan

THE TRIPLE-ZONE INSULATION FOR LIFETIME
PROTECTION OF HOT UNDERGROUND PIPES

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Affiliate of Barber Oil Corp. & Standard Oil Co. of California

American Gilsonite Co.
134-M West Broadway or
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1145 East Jersey St.
Elizabeth, N. J.

Send me more information on GILSULATE Insulation

NAME.....

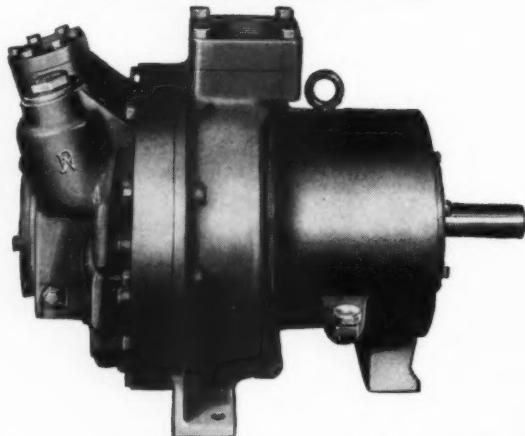
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JOSAM MANUFACTURING CO.
Dept. C.E.
Michigan City, Indiana

the designers, H. Walton Redmile & Associates, consulting engineers of Washington, D. C. and Baltimore, Md. Heated water is circulated through wrought iron piping embedded in concrete treads that support the 26 rows of terraced seats. Since the rays of energy radiating from the floor are converted to heat on contact with physical objects, comfortable temperatures are achieved without first warming the large building.

Piping under the straight runs of seats is in the form of simple grids, with semi-grids installed in the curved sections at either end of the auditorium. The heating system is divided into two zones, each with



UPPER RIGHT SHOWS BEGINNING OF WROUGHT IRON PIPE INSTALLATION FOR HEATING SYSTEM.

its own converter, circulator, and control. Each exchanger provides 1792 million Btu per hr, using 1680 lbs. of steam per hr to heat the water for the system. Steam is supplied by the University's central heating plant. The circulators furnish 162 gpm against a 15 ft hydraulic head. For ventilation, air is admitted at floor level and exhausted through propeller fans in the roof.

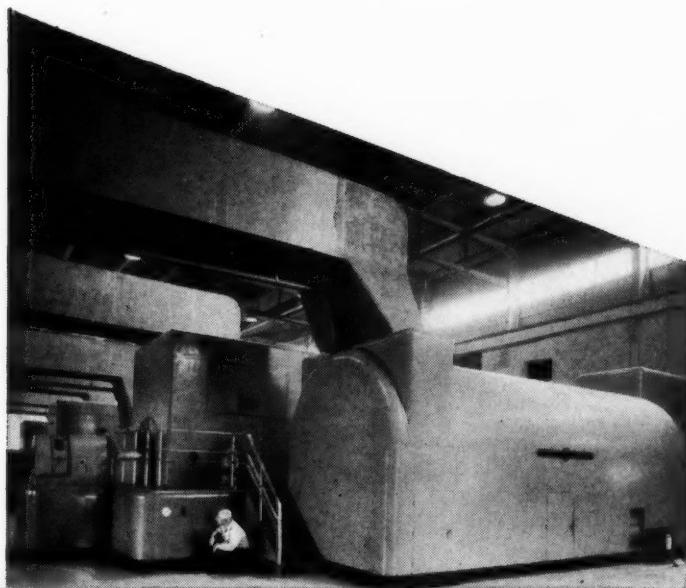
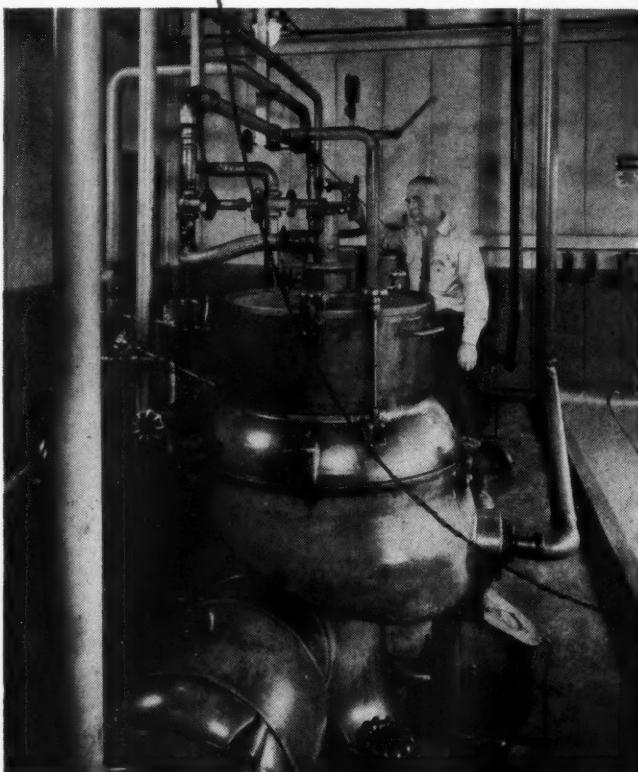
The Engineering Service Department of A. M. Byers Co., manufacturer of wrought iron pipe, worked with the consulting engineers on design of the radiant heating system.

Rapid Transit System Proposed for San Francisco Bay Area

A \$1½ billion rapid transit system for the San Francisco Bay area has been proposed on the basis of a two-year engineering study conducted by Parsons, Brinckerhoff Hall & Macdonald for the San Francisco Bay Area Rapid Transit Commission.

Under the plan, subway-elevated trains, possibly traveling on rubber-tired wheels, would cover a nine-county area at speeds up to 70 miles per hour. The trains would cross the bay between San Francisco and Oakland by underground tube, postponing the need for a second bridge that would cost more than \$300 million, according to recent estimates. The bridge strip now used for rails could be converted for additional motor vehicle lanes. The trains would travel over the Golden Gate

**15,000 kw. Gas Turbine
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BUT . . . ash deposit from the #6 fuel fouled turbine blading and nozzle ports . . . caused shutdowns . . . threatened to destroy parts of turbine by corrosion. Temporarily, the plant changed to costlier #2 distillate fuel.

Then technicians from the turbine manufacturer and from De Laval got on the job. It took work and engineering know-how to lick the problem. Solution? . . . a system of washing out the sodium and inhibiting the vanadium with De Laval "Nozzle-Matic"® Continuous Discharge Self-Cleaning Heavy Fuel Oil Purifiers capable of handling 45,000 gallons a day!

Mr. Norton M. Cobb, Plant Superintendent says: "To illustrate what the De Laval Centrifugal Washing System has done for us, let's take a look at the possible savings for oil alone . . . \$60.00 per hour when all three units are on the line . . . this makes the original cost of the equipment seem incidental . . . After burning more than 3,000,000 gallons of washed fuel, we have noticed no appreciable loss of power due to ash build-up and no visible signs of corrosion. We are well satisfied with our washing installation."

A complete report on the "Rutland Case" is available. Write for it.

*Trade mark reg.



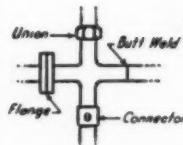
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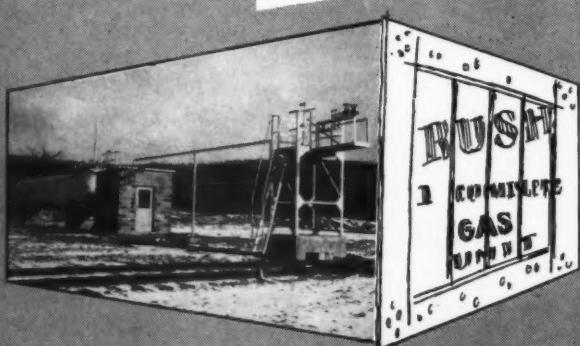
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Bridge at a new level and run deep into the San Francisco Peninsula to serve expanding housing developments and industries. Present commuting facilities of the Southern Pacific Co., the Key System, and Greyhound Bus Lines would be absorbed by the new integrated system.

The study indicated that the system's basic features, including the bay tube, San Francisco subway, and 123 miles of an eventual 390 miles of double track facilities, could be completed by 1962 at a cost of \$720 million. The second stage of the program, involving 42 miles of track extension, could be ready in 1970, with final completion in 1990.

According to the report, the proposed system would not only reduce commuting time, but could be operated at fares lower than those of existing commuter facilities, and could compete successfully with costs of private automobile transportation.

Stanford Research Institute has been engaged to make out a report suggesting methods of financing the transit system.

**European Engineering Developments
To Be Covered in Newsletter**

Starting this month, *European Engineering News Report*, a semi-monthly newsletter, will bring to American engineers and executives the latest information on new European engineering products, techniques, and technical developments.

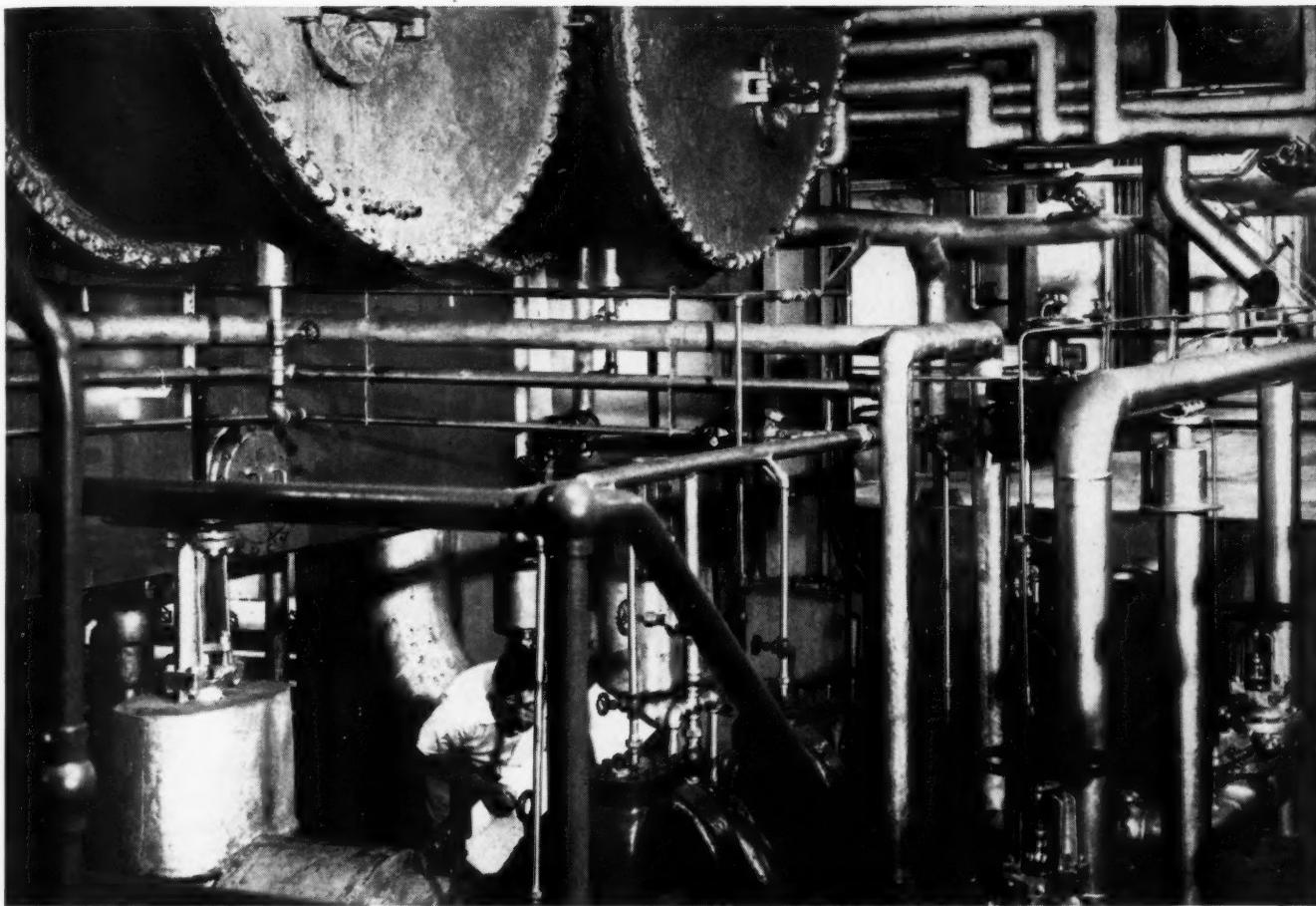
A staff of American engineers, working out of European headquarters in Zurich, Switzerland, will gather information in such fields as: power generation and distribution, hydraulics, gas engines, pumps and compressors, machine design, electronics, instrumentation and controls, metal working, heating and ventilation, and piping and valves. Fritz Hirschfeld, who has been European Editor of *CONSULTING ENGINEER* for the past year, is head of the new organization.

As an additional service in helping readers take advantage of data published in the Report, the staff will assist in establishing contacts or in obtaining more detailed information on products and developments. A year's subscription (24 issues), including technical follow-up services, is \$60.00.

Home office is at the Commercial Bank Building, St. Joseph, Michigan.

Expert Witness Reprint

Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for \$1.00. Please write to: Reader Service Dept., *CONSULTING ENGINEER*, 227 Wayne St., St. Joseph, Mich.



Deaerating Condenser Exceeds Guaranteed Performance

	guarantee	actual performance
Condensate depression cc of oxygen per liter in condensate	0 0.01	0 no measurable amount

This 50,000 sq. ft. steam surface condenser was installed by Lummus for Carolina Power & Light Company, Goldsboro Steam Electric Generating Plant, Goldsboro, N. C., Ebasco Services, consulting engineers. The unit is a deaerating type condenser of Lummus' patented design, serving a 66,000 KW turbine.

After three years of operation, it is still meeting and exceeding the original performance guarantees, as tabulated above, under all conditions of operation.

The unit was designed to condense 400,000 pounds/hr. of exhaust steam from the turbine at 2.10" Hg. abs. and deaerate the condensate. In addition to the condensate the unit must deaerate 50,000 pounds/hr. of drains from feed-water heaters and 100,000 pounds/hr. of cold make-up water at ambient temperature. The drains and make-up water enter the condenser above the tube bank and are deaerated in the Lummus patented de-aeration section. Tests run with supersaturation of

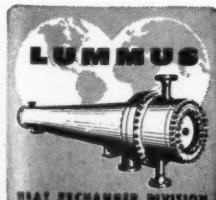
air in the cold make-up were handled with complete removal of oxygen and other dissolved gases without any unbalancing of the system.

Lummus-designed equipment gives results of this caliber consistently. May we sit in with your engineers on the project coming up?

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IN ENGINEERING

Colonel Sidney H. Bingham (Ret.), Consulting Engineer, has opened new offices at 109 East 35th St., New York 16, N.Y.

O'Brien & Gere, Consulting Engineers, Syracuse, N.Y., announce appointment of Walter K. Neubauer as an associate member. He will head the department of water supply engineering.

Wilberding Co., Inc., Engineers, are now located in their new building at 1023 20th St. N.W., Wash., D.C.

Five new members have been added to the executive committee of Foster D. Snell, Inc.: Daniel Schoenholz, director of product development dept.; Dr. Chester A. Snell, director of analytical dept. and v.p. of Crippen & Erlich Laboratories; Philip B. Ostrow, assistant secretary and chief accountant; Lloyd Osipow, director of surface chemistry dept.; and Richard L. Moore, assistant treasurer and director of personnel and public relations.

Sargent & Lundy has admitted Kenneth W. Hamming as a partner in the firm. He has been with the firm since 1940.

Foster D. Snell, Inc. has added Biochemical Procedures, 8350 Wilshire Blvd., Beverly Hills, Calif., as west coast laboratory of the firm. S. Louis Gaines will head the west coast operation.

M. S. Umbenhauer has been appointed manager of power plant design for The Fluor Corp., Ltd.

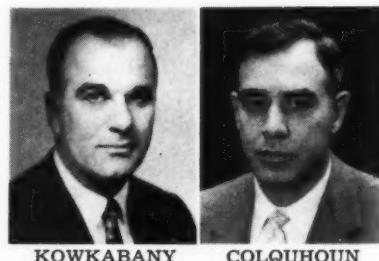
Paul C. Meyer, newly elected vice president of the Henry J. Kaiser Co., will be responsible for all administrative activities of the Kaiser Engineers Div. and its subsidiaries.

James P. O'Donnell, Consulting Engineer, New York City and Beaumont, Tex., announces the following staff promotions: John J. Lanigan to senior associate engineer while re-

taining the post of chief engineer, and George J. Feinman and Edward G. Fitzgerald each to associate engineer. The posts are newly created executive engineering positions.

Walter Kidde Constructors, Inc. has elected Gerard T. Shannon as vice president of Walter Kidde Engineers Southwest, Inc., a division of the parent company, with headquarters in Houston, Tex.

Edmund M. Kowkabany has been elected vice president of Burns and Roe, Inc.



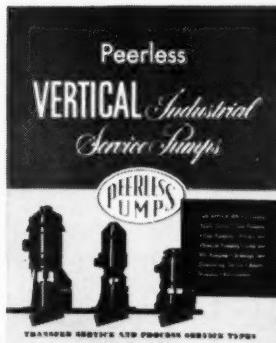
At Ebasco Services, Inc., E. K. Wilkins has been appointed vice president in charge of construction, W. H. Colquhoun has been made vice president in charge of engineering, and Albert W. Smith has been named assistant manager of the sales, marketing, and public relations consulting department.

John P. H. Perry has been elected a consultant in the firm of Seelye Stevenson Value & Knecht of New York City. Perry was formerly deputy to the assistant secretary of the U.S. Air Force in charge of U.S. Air Base construction.

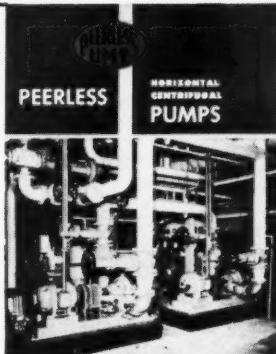
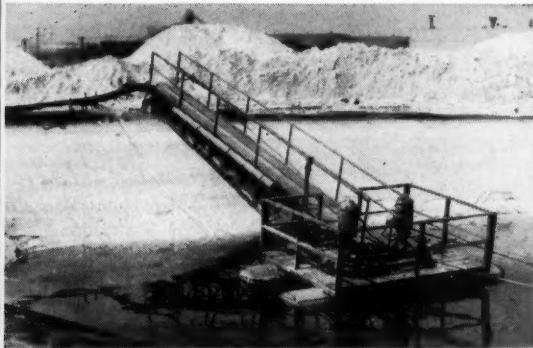
F. W. Littell has joined the firm of MSI Communications Consulting Engineers, Microwave Services, Inc. as a senior consultant.

G. O. Noville & Associates, Inc., Los Angeles firm of consulting, design, and development engineers, has been awarded a \$100,000 contract

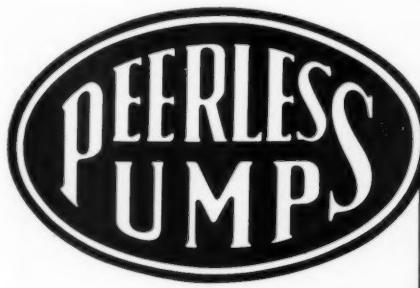
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Chicago	7	Phone:	WAbash 2-2211



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by the Department of the Army for research leading to new types of equipment to be used by the armed forces and for further improvement of efficiency in existing equipment. Admiral Richard E. Byrd has appointed G. O. Noville, president, his personal engineering consultant on sub-zero operational problems.

Dr. Louis C. McCabe, formerly scientist director in the United States Public Health Service, announces formation of a new firm, Resources Research, Inc., an organization of consultants specializing in solving air and stream pollution problems. He will be joined in the new enterprise by Frederick S. Mallette, executive secretary of the committee on air pollution controls and research manager of the American Society of Mechanical Engineers; and William S. McCabe, consulting geologist of Casper, Wyo.

Horizons Inc., Cleveland industrial and governmental research organization, has named Dr. John T. Burwell, Jr. as vice president; Dr. James L. Wyatt, head of the department of metallurgical engineering; Bertram C. Raynes, head of the department of chemical engineering; and Calvin A. Schunemann, head of the analytical chemistry section under the department of chemistry.

Offices of Yamasaki, Leinweber & Associates are now located at 103 West 5th St., Royal Oak, Mich.

Paul Rogers, head of Paul Rogers & Associates, Consulting Engineers, of Chicago, Ill., has been elected secretary of the Illinois section of the American Society of Civil Engineers.

John R. Snell, formerly head of the civil and sanitary engineering department of Michigan State University, has organized a new firm of consulting engineers, John R. Snell and Associates. Offices are at 6103 Lake Lansing Dr., Haslett, Michigan.

The H. K. Ferguson, is establishing a division office in Atlanta, Ga., at 1528 Fulton National Bank Bldg. Cephas P. Quattlebaum has been appointed assistant contract manager for the eastern district and head of the new office.

Carlton S. Proctor is the new president of the American Institute of Consulting Engineers, succeeding Francis S. Friel, of Philadelphia. Colonel Proctor, a partner in the firm of Moran, Proctor, Mueser & Rutledge, is a past president of the American Society of Civil Engineers and a trustee of Princeton University. Other new officers are: Richard Hazen and Robert W. Abbott, vice presidents; Herschel H. Allen, Ellis E. Paul, and Maurice F. Scharff, members of the governing council.



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Long-Span Q-Deck

LIGHT WEIGHT • GREAT STRENGTH • EASY TO INSTALL • GOOD LOOKING

After considerable testing and research, H. H. Robertson Company is pleased to announce the availability of a new product much needed in modern construction—a steel deck that will span great distances with the required load-carrying capacity. This new *Long-Span Q-Deck*, now in production, carries with it all the basic qualities and advantages of Robertson's well known Standard Q-Deck. Tight side laps become standing seams and are caulked and mechanically fastened at regular intervals to act as a vapor barrier and for structural stability. Units are easy to handle and erect with a minimum crew. They install quickly and tightly because of precision manufacture. *Long-Span Q-Deck* fills a long felt need in schools, supermarkets and other buildings where longer single spans bring construction economies and design flexibility. Any standard insulation and built-up water-proofing can be used. Use the coupon to write for technical literature about this new Robertson product.



Individual units are 12" wide by 7½" high, rolled from metal-coated steel in 18, 16, 14 and 12 U.S. Gage. Standard lengths up to 32 feet maximum.



For supermarkets and schools much greater latitude of design is allowed by increasing deck span. Considerable saving in structural steel is made possible, and time and labor are cut down in the erection of the deck itself.



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**REPLACE them
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VALVES**

✓ Use the Angle Body and Save the Price of an Elbow Fitting

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HERE'S PROOF:

One of America's large railroads had a 6" gate valve installation that operated on the average of 55 times a day. In addition to frequent repairs, this valve had to be entirely replaced every 3 months.

In the Fall of 1947, this valve was replaced with a 6" G-A Flowtrol Valve. Now—more than 7 years later—this valve is still operating perfectly and not one parts replacement has been made!

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**Notes
FROM
ABROAD**



Australian Hydro-Electric Plan

The Snowy River Development Plan, a vast hydroelectric and irrigation scheme for Australia, has been amended by deleting one of the proposed smaller dams and diverting the water into the Adaminaby Dam. The new plan will effect a saving of \$50 million in capital cost and increase the hydro-electric output by more than 15 percent. Total cost of the development is expected to exceed \$1 billion over a period of 20 years. It is the biggest construction job ever tackled in Australia. Contracts for sections have already been let to U. S., French, Dutch, and Australian firms.

Pipeline for South Africa

A feasibility and economic aspect study of the possibility of constructing a 400 mile oil pipeline from the Port of Durban to the Johannesburg area will soon be conducted by a Union of South Africa government commission. If constructed, it would lighten traffic between South Africa's largest industrial and mining complex and the Union's most important harbor. It might also be expected to lower the present inland price of 50¢ per Imperial gallon of gasoline. The line would take about a year to build with an operating cost of ½ to 1¢ per Imperial gallon.

Atoms in Africa

The start of uranium production at the Virginia Mine in the Orange Free State Province of the Union of South Africa brings the total number of plants turning out

uranium oxide to 13. Eventually, uranium production is expected to contribute about \$160 million a year to the national income.

As part of the Union's adaptation to the demands of the atomic age, a 16 million electron volt cyclotron has been built near Pretoria by the Council for Scientific and Industrial Research. Construction was carried out according to designs of the Nuclear Physics division of the National Physical Laboratory.

Nile To Be Harnessed

One of the world's largest dams, to be built at Asswan, Egypt, will have a storage capacity of 170 million cu yd, four times that of Boulder Dam. Two branches of the Nile Delta will be closed as part of the project. At present, 35 percent of the Nile's water runs into the sea instead of being used for irrigation purposes.

The British firm of Sir Alexander Gibb and Partners will act as consulting engineers for the whole scheme, which, when completed in about ten years, will have cost \$641 million. The Egyptians hope that the World Bank will finance the project. Iron Curtain countries have already offered money, engineers, and machinery.

Public Works in Yugoslavia

The U. S. has approved the release of \$5 million in counterpart funds for the construction of a new steel bridge across the Sava River connecting Belgrade with western Yugoslavia. The new bridge, with an 800-ft main span, will cost \$8.5 million and will replace a bridge



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Hagan pneumatic, hydraulic and electronic instrumentation, control and power units are built to maintain the highest standards of accuracy, yet render long, trouble-free service. Call on your Hagan engineer for specific information on any Hagan unit, or write for the new 28-page bulletin which describes Hagan products and services. Ask for Bulletin GSP-901-1.

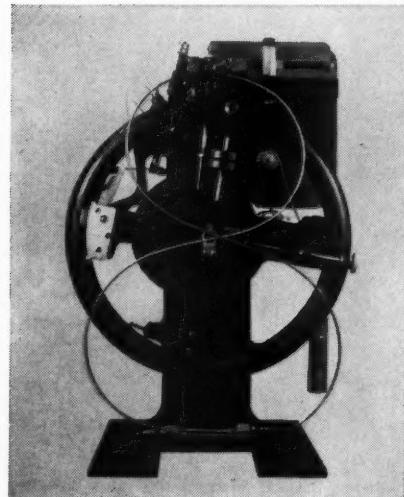
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FEBRUARY 1956



Hagan Ring Balance Meters

Simple construction and direct action are the reason why Ring Balance Meters render such accurate, trouble-free service. Versatile in application, the Ring Balance Meter is easy to maintain—dead weight calibration permits checking without disconnecting the meter from the line.

The accuracy and rugged construction of this meter is typical of all Hagan components.



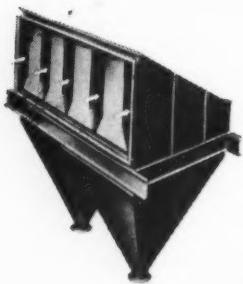
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OF dust...

Your plant and equipment suffers . . . your community goodwill fades away. These problems can be solved. Prat-Daniel Collectors are designed for the control of industrial dusts and flyash. Multiple small diameter tubes provide powerful centrifugal forces, resulting in sustained high collection efficiency . . . even with ultra-fine dusts.

Whether the problem is industrial dust or flyash, you are assured of satisfaction with P-D Collector Systems, engineered to meet your specific needs.

Write for Reprint No. 102 titled,
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SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

destroyed during World War II. A German firm designed the new bridge and is constructing it along with several Yugoslav firms.

During the last three years the U.S. has released over \$100 million in counterpart funds for Yugoslav land-reclamation, health, sanitation, and other projects. At present, Yugoslavia is asking for counterpart funds for several other projects, including that of the important Zagreb-Ljubljana highway and the tourist highway along the Adriatic coast.

Austrian Hydro-Station

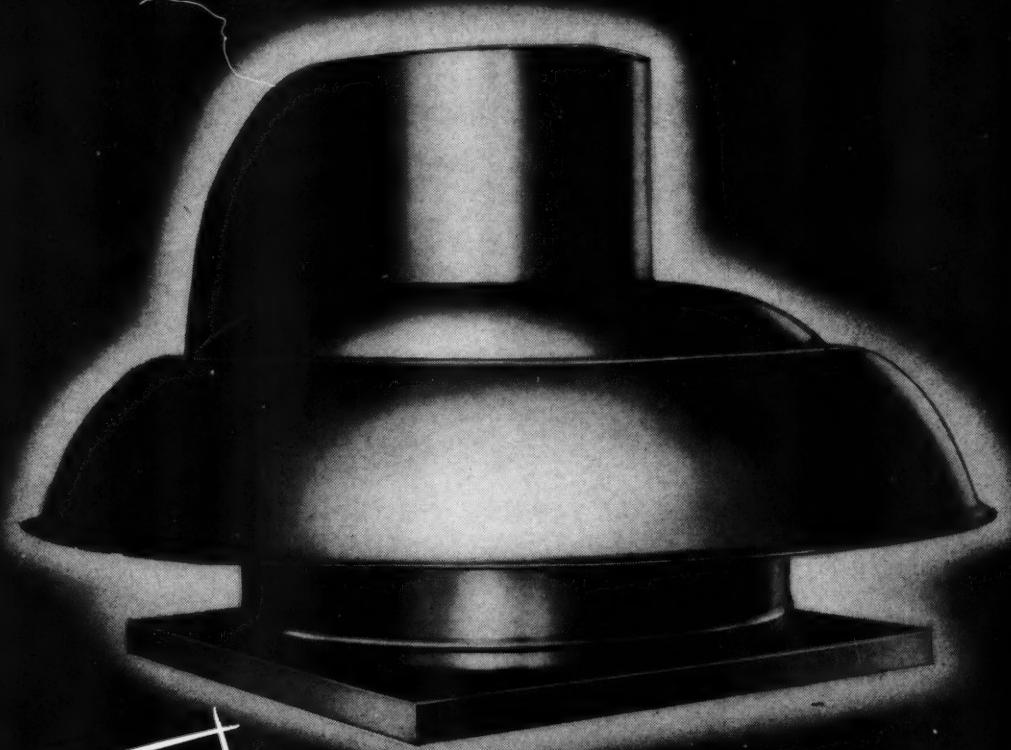
Construction work on Austria's big hydro-electric power plant at Kaprun, on the 12,454-ft high Grossglockner mountain, is now completed. After the installation of all generators and other electrical equipment, the Kaprun plant will work at full capacity as of this coming April or May.

Resources Inventory by Air

Under provisions of the Colombo Plan for the economic development of South and Southeast Asia, a contract has been awarded to Photographic Survey Corp., Ltd., of Toronto, Canada, for an inventory of Ceylon's resources by aerial survey methods. Cost of the survey, spread over a two year period, will be about \$500,000.

The whole island will be photographed from a Lockheed Hudson airplane and mosaics and maps prepared from the photographs. Geological and forestry studies will be made at the same time and a river basin examined from the air and on the ground by a group of agricultural and irrigation experts. Arrangements will also be made to replan the city of Kandy with the help of air photographs of the present city.

The project calls for establishment of an operation center for integration of aerial photographic studies on a continuing basis, laboratory facilities, and training of Ceylonese technicians in modern air survey methods. J. M. Henderson, project manager for a similar



new!

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For whisper-quiet operation. Running at low tip speeds, moves large volumes of air efficiently against static pressure. Low in silhouette, distinctively profiled, blends well with modern architecture. Send for new 16-page catalog which also contains a section, "How to Select a Roof Ventilator."

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with the meter on the door

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ON OPERATIONS LIKE THESE... TO MAKE SAVINGS LIKE THESE**

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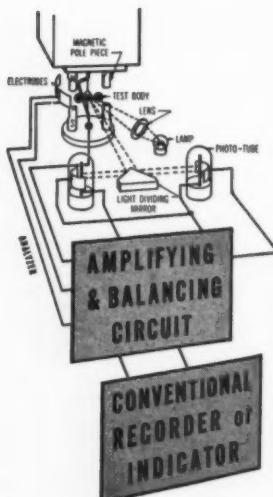
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Accuracy: 1% of full scale.

Multi-Ranges: Any instrument may be supplied with two or more ranges.

Note: For ranges narrower than 0-5% O₂ ask about the Model G2.

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resources inventory for Pakistan, will head a group of specialists in aerial surveying, photography, geology, and soils engineering.

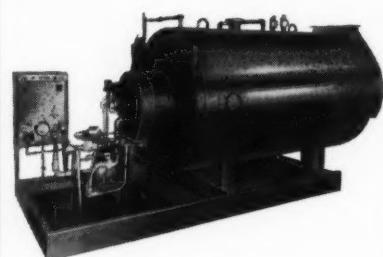
Persian Railway Modernization

Nine West German railway-building experts will go to Teheran to help Persia modernize the State-owned railways. The Germans are to build railway lines, station buildings, hotels, and homes for railway employees.

Research on Boiler Fouling

Recent research by a Joint Technical Panel of the (British) National Coal Board and Central Electricity Authority has shown that in some modern industrial boilers with chain-grate stoker installations the very small quantities of metallic chlorides that are found in coal can cause serious boiler fouling.

National Coal Board scientists have reported that in some cases



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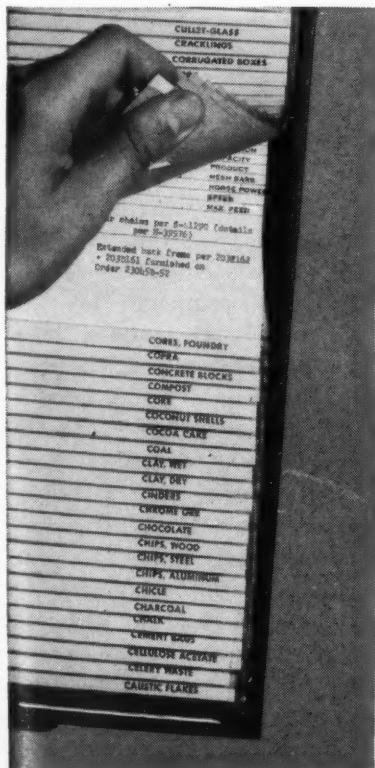
Established 1864



Protect your conveyor or elevator belts. Jeffrey's slatted pulley solves sticky problems. Ordinary belt conveyor pulleys often collect sticky or abrasive material on their solid faces. This wears out the belt and gets it out of alignment. Jeffrey's answer is the slatted wing type pulley shown above. It is self-cleaning. Belts last longer. Downtime is greatly reduced. Described in Bulletin 898.

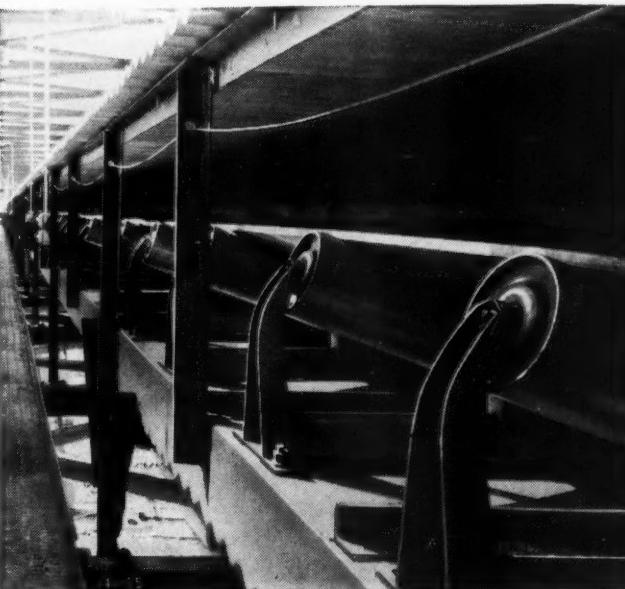


Again and again the White Rock Sewage Treatment Plant at Dallas, Texas, has been expanded. Each time the equipment added has been Jeffrey. Progressive municipalities and industries everywhere are meeting sewage, water and industrial waste treatment the mechanized way. They are looking to Jeffrey for plant facilities. Catalog 833-A describes Jeffrey sanitation equipment.



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A dozen Jeffrey bulletins describe equipment for reducing different materials. For proper data, tell us your problem.



Merchandise. No "soft goods" among the millions of pounds of merchandise which Jeffrey supplies annually. Hard work is the chore of every item—conveyor-belt idlers like those shown here, the miles of power transmission and conveyor chain in use throughout industry, or any of the hundred-odd other Jeffrey products. Materials and workmanship are the finest. Into each has gone Jeffrey's long experience in engineering and building elevating, conveying and processing equipment. Catalog 418 should be in every engineering department file.

We can help you work out the most reliable, efficient and economical solution to problems involving any of the operations described here. Jeffrey engineers are available to advise on methods and they will assist in selecting Jeffrey equipment best suited to each task. For any of the literature mentioned above, and for this engineering help, write The Jeffrey Manufacturing Company, Columbus 16, Ohio.

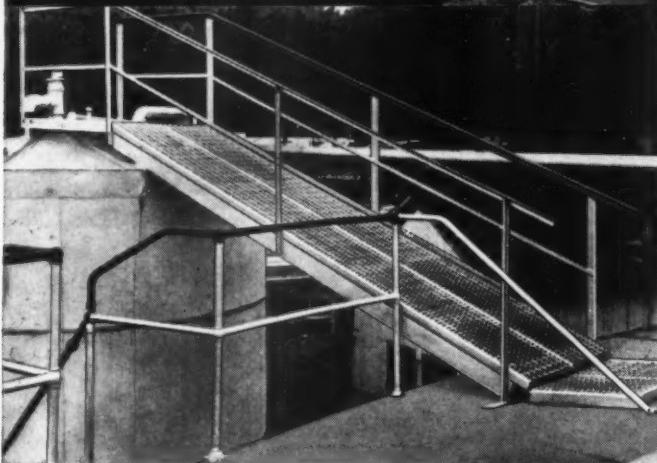


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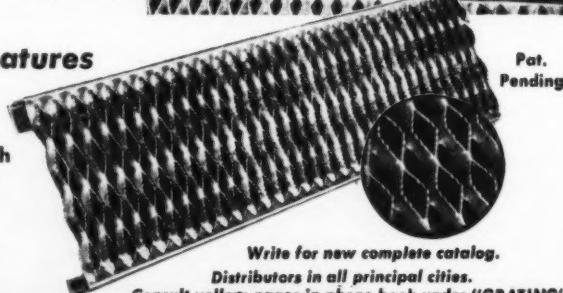
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Oil tank in Port-
land, Ore.

See how Shell Oil
uses Grip-Strut for
a safe ramp be-
tween tanks.

View looking down
circular stairway
on Shell Oil tank
shown above.



as little as 0.3 percent of chlorine (equivalent to a slightly higher percentage of metal chlorides) in the coal can cause serious loss of boiler efficiency. When the percentage of chlorine present is from 0.5 to 0.6 percent, the rock-like deposits on the tubes of the boiler may form so rapidly that the boiler has to be taken out of service for cleaning after only 500 hours.

The loss of boiler availability through such fouling may become even more serious in the new high-efficiency pulverized fuel boilers now being installed in Britain.

Progress is being made in research into reducing the chlorine content of coals by extracting part of the chlorine with water and also into the possibility of modifying boiler designs to extend tube life.

Moselle Waterway Development

French and West German delegations have opened a discussion, scheduled to run three or four months, on proposals to develop the Moselle waterway as a low-cost transportation link between French steel mills and Ruhr coal pits. Several proposals for the Moselle development have been worked out by each side. The purpose of the present conference is to decide if one of these proposals, or a composite of several of them, can be used, or if new technical work is required. For a long time France has sought the construction of canals and other works to develop the Moselle in order to move Ruhr coal by barge to French mills instead of by relatively expensive rail transport. This would enable French steelmakers to reduce their selling price and thus put them in a better competitive position.

Potential Ruhr in Northern Greece

The German Government has lifted the limit of 200 million marks (about \$50 million) set on its long-term credits to Greek development projects. The agreement is likely to have an important effect on the industrial developments being planned in

The Newport News plant . . . served by direct rail and deep water shipping . . . comprises more than 225 acres with large productive capacity. It includes five steel fabricating shops, five main machine shops, foundries and pattern shops covering an area of 11 acres, complete forge and die shops, heat-treating furnaces and other metal processing equipment along with shop erection and test facilities.



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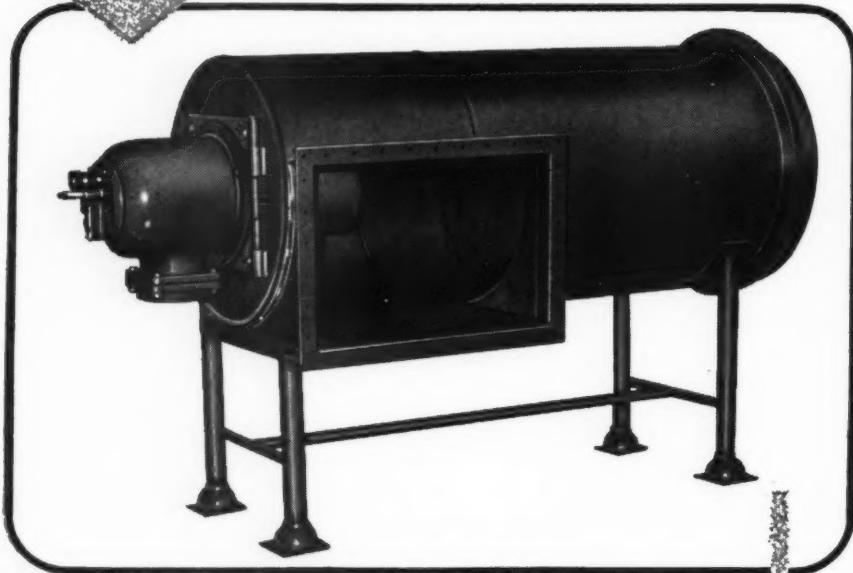
In the vast plant, shown above, Newport News craftsmen complete your orders with specialized production techniques, and with sound experience acquired through construction of thousands of products ranging from small components on rayon spinning machines, to the giant 165,000 hp hydrau-

lic turbines at Grand Coulee.

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Readily fitted to ovens, kilns, spray dryers, etc., the THERMAL Type CA Air Heater is an ideal source of heat where products of combustion may be mixed with the air. Oil, gas or combination firing is available without change in heater construction.

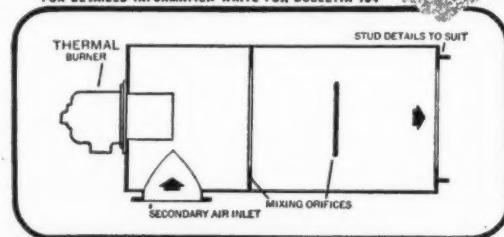
NO REFRACTORY REQUIRED . . .

The THERMAL High Velocity Burner built into the heater permits combustion to be substantially completed within the burner itself. Thus the heater is basically a mixing chamber wherein the products of combustion are mixed with the air being heated. Refractory is not normally used. Successful applications have been made ranging from under 200,000 BTU/hr. to over 20,000,000 BTU/hr. and at all pressure levels.

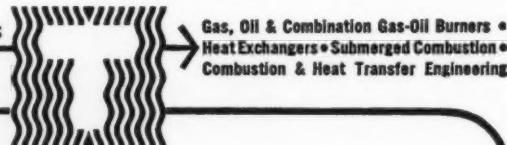
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Northern Greece, centering on the city of Ptolemais.

In the conversion of the Ptolemais area into one supporting industries with an expected potential value of \$150 million, the exploitation of lignite is of major importance. Apart from still distant prospects of striking oil in commercial quantities, lignite is the only fuel medium that is native to Greece. The lignite deposits at Ptolemais, estimated to total between 500 million and 1 billion tons, are at a conveniently shallow depth, and, because of their special wax-like properties, are easily converted into briquettes by drying under pressure.

After prolonged study of the potentialities of Ptolemais, with the help of experts of the American Aid Mission in Greece, the Government decided to grant the exploitation rights to a Greek company — Chemical Products and Fertilizers.

Most of the \$20 million of capi-

E R N S T

Boiler Accessories

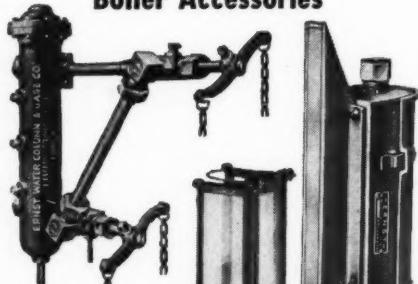


Fig. 4
Inclined Water Gage



Fig. 10
Plain Sight Illuminator



Fig. 31
Guard

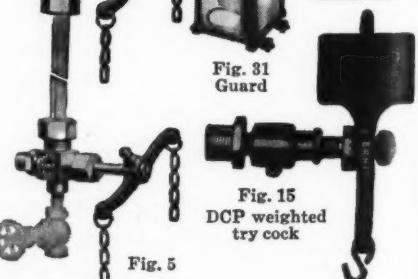


Fig. 15
DCP weighted try cock

Standard vertical bronze water gage, 350 pound

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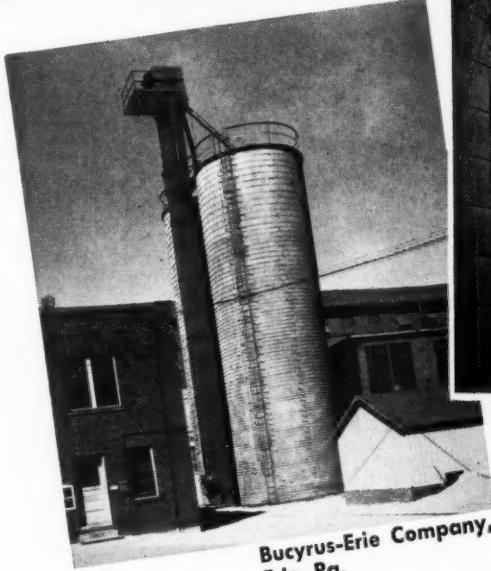
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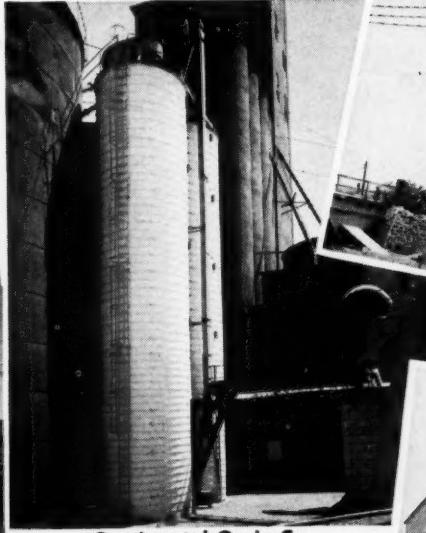
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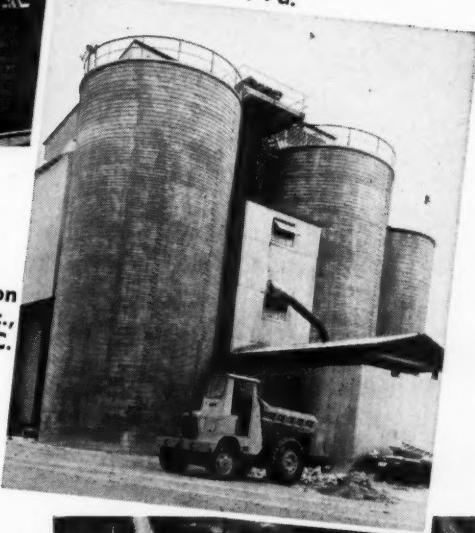
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Continental Grain Co.,
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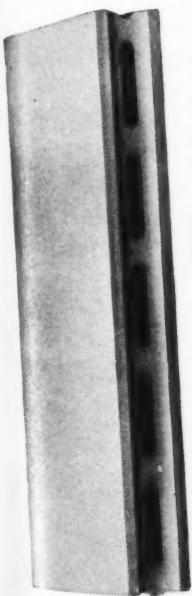
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tal required for the Ptolemais development will be lent by the Economic Development Financing Organization — an outgrowth of the body administering American Aid funds. The Greek company will invest \$3 million and another \$3.5 million will come from the German Krupp firm.

It is this cooperation that points to the future status of Ptolemais as a Grecian Ruhr. With a network of chemical and metallurgical industries it would create a much needed center of industry away from Athens, and at the same time solve the pressing problem of unemployment in northern Greece.

Power for Copper Mines

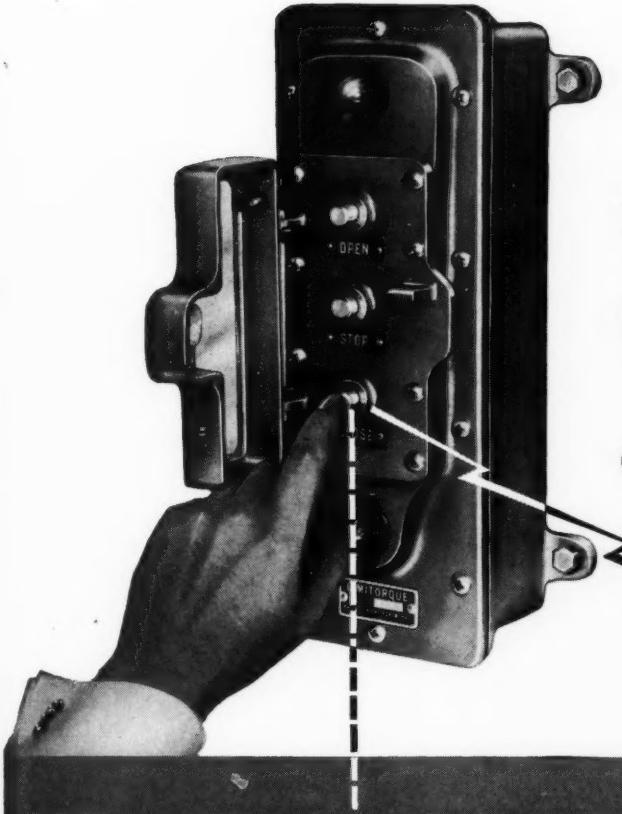
The Federal Hydro-Electric Board of the Central African Federation (comprising the Rhodesias and Nyasaland) has entered into contracts for construction of the Kariba Dam, to be constructed on the Zambezi River. The 400 ft high dam will create a lake one million acres in area.

During construction, the river will be diverted through a 3/4 mile long tunnel. This tunnel will also carry the river during the six or seven months when the river is low. Peak floods will be taken care of by a channel 1/3 of a mile long, running through the hillside to a depth of 80 ft at the deepest point, and from 150 to 300 ft wide.

Main purpose of the dam will be to supply electric power to Northern Rhodesian copper mines. Three consulting firms are working on the project: Sir Alexander Gibb and Partners, England; A. Coyne & J. Bellier, and S.O.G.E.I., both of France.

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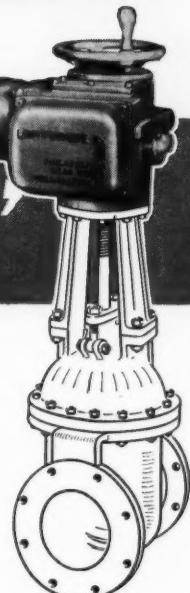
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The above is a Type SMA-000 LimiTorque for operating smaller valves. There's a type and size of Limi-Torque for every valve operating need.



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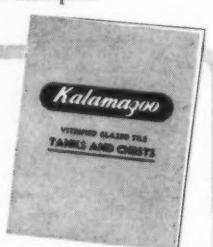
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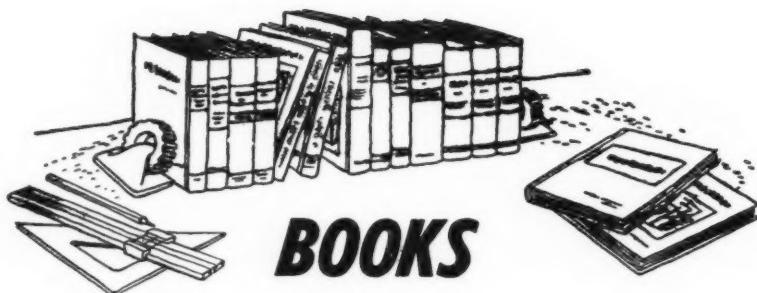
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ELEMENTS OF ELECTRICAL ENGINEERING, Sixth Edition, by A. L. Cook and C. C. Carr; John Wiley and Sons, Inc.; 682 pp; \$6.75.

Reviewed by Eric T. B. Gross
 Illinois Institute of Technology

This college textbook, originally written over thirty years ago by A. L. Cook, has been used as the basic

text of the usual two-semester course given to non-electricals majoring in some other branch of engineering.

The rapid advances in electrical engineering have been covered regularly in new editions, and the book has now become a good size volume of nearly 700 pages. The present edition has been prepared with par-

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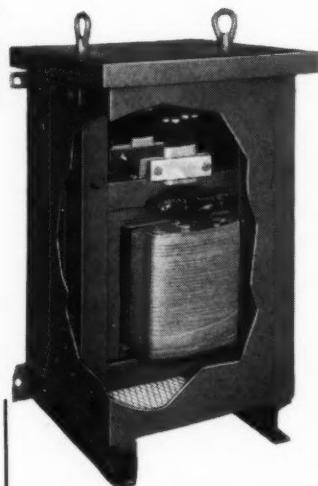
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ticular care. The authors point out that this revision resulted in a practically new book.

The book is truly a "textbook of principles and practice" as its subtitle indicates. It covers in six parts, subdivided into a total of 36 chapters, all the topics which a practicing non-electrical engineer may wish to survey or analyze without consultation of a specialist. Included is information on such "obsolete" equipment as synchronous converters, still to be found in many plants providing d-c power for electrical subways and other applications, as well as a comprehensive discussion of various modern electronics circuits.

The book needs no further recommendation. It has established its place not only as a college text but also as part of the library of many practicing engineers as the volume they use or wish to consult in order to clarify a basic problem in one of the branches of electrical engineering.

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PRINCIPLES OF ELECTRIC UTILITY ENGINEERING, by Charles A. Powel; The Technology Press of M.I.T. and John Wiley & Sons, Inc.; 251 pp; \$6.00.

Reviewed by John C. Hitt,
Jackson & Moreland

The background of this book is interesting. Upon his retirement from Westinghouse a few years ago

Mr. Powel (a past president of AIEE) was invited to join the M.I.T. staff as a Lecturer. The subject matter was to be various phases of power engineering. The purpose was the revival of interest in this field among M.I.T. electrical engineering students. The present book is based on those lectures.

In reviewing this book two questions are pertinent. Does it present to electrical students an interesting and balanced picture of the engineering work they may expect to encounter in the electric utility industry? Does the book have value for engineers in the consulting field?

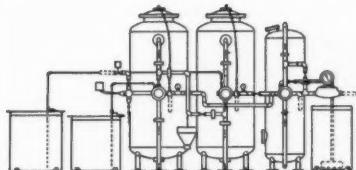
Let us consider the first of these questions. The author has appropriately remarked in the preface that any chapter could be expanded into several volumes. His very condensed discussions of a multitude of subjects give a good picture of present practice. However, I feel that his purpose of exciting the interest and imagination of students would be better served if he devoted more attention to the important engineering problems in the future of the public utility field. Typical subjects of this type, to which the book gives little or no attention, are as follows:

Economic dispatch of power systems, including hydro dispatch and allowance for transmission losses.

System planning problems; such as optimum size of generating unit

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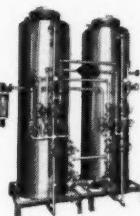


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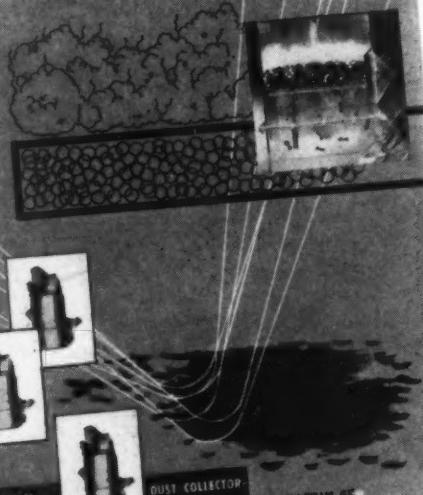
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Station service systems, which will present quite new problems as generating unit sizes continue their rapid upward trend.

The distribution system, which is only beginning to receive the degree of engineering attention to which its large proportion of utility system capital investment entitles it.

The most important subject that has been slighted is the role that economics should have in public utility engineering. The utility industry is nearly unique in its high ratio of capital investment to annual income. This makes extremely important the intelligent evaluation of capital expenditures, which is necessarily a combination of economics and engineering.

Returning now to the second question, it is felt that this volume will be of interest to a consulting engineer, but not of definite value to him. It will broaden his understanding of public utility engineering, if his present knowledge is rather limited. However the book is of necessity too condensed to be of much help for specific problems.

ALSO AVAILABLE

ATOMIC ENERGY GUIDEBOOK, The Atomic Energy Guideletter; 96 pp, paper bound; \$7.50.

This is a non-technical source book on practical uses of nuclear energy stressing the present status and future possibilities and written for the layman. It includes three exclusive articles: "How to Enter the Atomic Energy Business," by Edward R. Trapnell; an interview with him on "The Present Status of Atomic Energy;" and "The Future of Atomic Energy," by Eugene M. Zuckert.

1950-1951 BIBLIOGRAPHIC SURVEY OF CORROSION, NATIONAL ASSOCIATION OF CORROSION ENGINEERS; 430 pp; \$12.50 (\$10.00 to NACE members).

Summaries of 4454 corrosion and corrosion prevention articles, books, and brochures published in 1950-1951 are compiled in this volume. Literature is classified in eight main groups in the NACE system: general, testing, characteristic corrosion phenomena, corrosive environments, preventive measures, materials of construction, equipment, industries.

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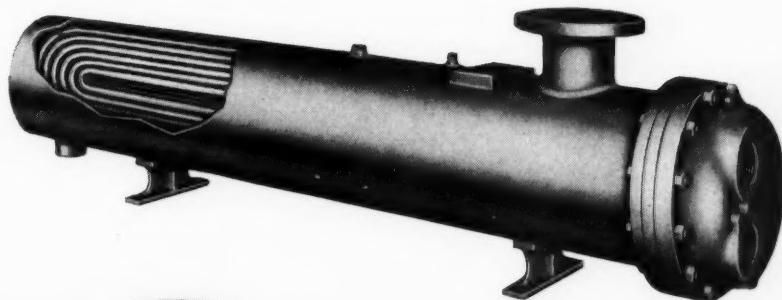


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consulting engineers' calendar

Date	Sponsor	Event	Location
Feb. 13-17	American Society of Civil Engineers	National Winter Convention	Baker Hotel Dallas, Texas
Feb. 16	Illinois Institute of Technology and American Society of Civil Engineers	Lecture on "A Review of Fundamentals and Recent Work in Shell Theory"	IIT Campus Chicago, Ill.
Feb. 20-23	American Concrete Institute	52nd Annual Convention	Bellevue-Stratford Hotel Philadelphia, Pa.
Feb. 26-29	American Institute of Chemical Engineers	Meeting	Statler Hotel Los Angeles, Calif.
Feb. 27-29	American Management Association	2nd Annual Electronics Conference	Hotel Commodore New York, N. Y.
March 14-16	American Society of Mechanical Engineers	Aviation Division Conference	Beverly-Hilton Hotel Los Angeles, Calif.
March 19-23	American Society of Tool Engineers	Annual Meeting and Exposition	International Amphitheatre Chicago, Ill.
March 21	Illinois Institute of Technology and American Society of Mechanical Engineers	Lecture on "Vibration"	IIT Campus Chicago, Ill.
March 21-23	Illinois Institute of Technology and Armour Research Foundation	18th Annual American Power Conference	Hotel Sherman Chicago, Ill.
April 8-20	Illinois Institute of Technology and Armour Research Foundation	National Research Industrial Conference	Chicago, Ill.
April 9-12	American Management Association	Silver Anniversary National Packaging Exposition	Convention Hall Atlantic City, N. J.
April 10-11	Midwest Research Institute	Symposium for Management on Applications of Analog Computers	University of Kansas City Kansas City, Mo.
April 17-19	Atomic Industrial Forum	Atomic Energy Conference	Atlanta, Ga., and Oak Ridge, Tenn.
April 18	Illinois Institute of Technology and Armour Research Foundation	Lecture on "Recent Developments in Structural Research"	IIT Campus Chicago, Ill.

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